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MINERALS

AND

MINING

NOVA SCOTIA

BY

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MINING RECORD OFFICE.

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EXPLANATORY.

It is said of the famous Scottish preacher, Dr. Guthrie, that his introductions were, at times, almost as long and quite as interesting and illuminating, as his discourses. However it may be with hearers, readers, as a rule, are content to place introductions in the necessary evils' class. The question may be asked: "What is the necessity of a book treating of Nova Scotia's minerals?" Have not Sir William Dawson, and Sir William Fairburn; the late loveable Hugh Fletcher and the living Faribault, imparted, in many treatises, all the information necessary, as to the provinces geology? Has not Richard Brown said almost the last word on the coal fields of Cape Breton? Has not the late H. S. Poole made an exhaustive study of the strata in the Pictou coal field, and Hind, laid bare the minerals of Cumberland County? Have not How, and Hartley and Gilpin, and others of note, told of what the province possesses of useful minerals? May be, but

What was written by the geologists was, is, for Scientists and mining experts. The words of this volume are not for these, particularly, but rather for capitalists, manufacturers, economists, and the public at large, among whom there is a very large number of very inquisitive people, some seized, at times, with a spirit of adventure, who having, mayhap, failed in an endeavor to make two blades of grass, instead of one, grow on the earths surface, are eager to take a chance to add to their own and their country's advantage by delving and blasting in its bowels.

Since the passing of Dawson and the others much

has happened. Science has made so marvellous progress, that the views of even the best of them have to be revised, and their conclusions added to or subtracted from. How, Gilpin, and Piers have written specially of the "Economic Minerals of Nova Scotia," but possibly all omitted what, at this time are deemed desirable betails. This is affirmed by the fact that demands are continuously being made for information relative to some one or other mineral, its extent, quality and location.

Comparitively little has been written treating of the development of the mineral industry, a development heartening, as in the case of coal, and somewhat disheartening as in that of iron and copper.

The great war has led to an unprecedented demand for many minerals, so great has been the wastage of the products of minerals that renewed interest must soon take place, in the search for and exploitation of many kinds of minerals, to supply the anticipated after the war demand. Our province, it is declared, has stores of many minerals and should come in for a large share of attention. The demand for coal, which has not for the past few years been adequately met, has already stimulated to efforts to locate and develop new seams in different parts of the province, and as no doubt many of these efforts will be crowned with success, the next decade is expected to witness a gratifying increase in coal production. It is likewise reasonable to expect that some of the minerals hitherto, in a measure, neglected, will come in for intelligent and practical attention and become of substantial value to the province. Much, probably, of what is said in these pages could be gathered by readers, who have the necessary time and inclination, from the Reports published by the several Mines Departments ; from How, Dawson, and other sources. No one of these sources has been largely drawn from. Whence then does the writer obtain his information? He dare not, like the author of 'Ginx's Baby,' declare he evolved it out of his own consciousness. Truth to tell it has been drawn from many sources, whose locations time has wholly effaced.

Spurgeon tendered to preachers this advice: "Mind the theme of your discourse suits yourself. A beard-

less boy should not choose as his text, 'I have been young but now am old,' " An inference is that experience counts, I have drawn from this source which happily does not demand a stately or a sturgid style. The teachings of experience may readily be conveyed and appropriated, while, of that of the schools, it may be said what the old lady said of her minister when enjoined to give a frank opinion "Oh well, he is invisible six days of the week, and on the seventh he is incomprehensible,"

There may be reminiscences ; if so, they are given with the full knowledge that in some quarters, to be reminiscent, gives the impression of incipient senility.

The chief end aimed at is to present the possibilities Nova Scotia offers as a field for legitimate mining speculation. The word is used advisedly, for it may not be denied that mining is subject to risks other than diminished demand and fluctuation in 'market' prices.

The book would not have been written at this time, nor in its present form, had it not been for an idea conveyed by Mr, R. D. Anderson of the Nova Scotia Mines Department. Happening into the office Mr. Anderson said, "Look over this stuff, which I have put together in spare moments, and if it suits use it in the Mining Record. The 'stuff' had reference to the economic minerals of Nova Scotia, principally those less known. I read it over and said to Mr. Anderson, "You have given me a foundation on which I shall build."

When the book was mapped out, chapters were purposed to be written dealing with improved conditions, the social uplift of mine workers, and kindred subjects. The planning, for the time, has gone aglee; the subjects still remain, and may, in the future, be deserving of attention.

R. DRUMMOND.

Stellarton, N. S.,
November, 1918.

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MINERALS AND MINING, NOVA SCOTIA.

WHAT IS A MINERAL?

The word mineral is of so wide meaning that it has been found necessary by writers to prefix the word by an adjective such as "economic" or "useful" in order to distinguish minerals of value from those commonly held to be valueless. A mineral is defined to be "any inorganic body which is found on the surface, or within the earth; or rock or stone; a metallic ore; a metal." Some may imagine that in a court of law whin, rock or sandstone would not be held to be a mineral. That is a mistaken notion. The British courts have given almost as comprehensive a definition of the word as the dictionaries. One of the notable law cases is that of the Attorney-General versus Tomlins, in which Lord Chief Justice Fry held that the word "mineral" included "every substance which can be got from underneath the surface of the earth for the purpose of profit." It will be noticed that his Lordship's definition is not so wide as that of the dictionary. But judges differ, and so it is found that Lord Adam in the case of Nesbit vs. the North British Railway Coy., broadens his brother's definition and declares without qualification that "common earth and sand are minerals." Of course all must admit that the definition is technically unassailable, and yet the ordinary individual will not have it so, and

declares that there must be, or ought to be, distinction between a rock, which is neither fusible, ductile or malleable, and ore or quartz, which are fusible and ductile, and malleable after fusion. Possibly the easiest way out of the difficulty is to accept Lord Fry's opinion that anything dug, or mined from the earth, for the purpose of profit, is a mineral. At any rate that is the definition most acceptable to the man on the street, whose ideas it may at times be impolitic partially to ignore, and at other times calamitous to do so wholly.

The writer has a further reason for a preference to Lord Fry's opinion. Sir Archibald Geikie has defined a mineral in terms somewhat as follows:

"A mineral is an inorganic substance having a definite chemical composition and generally of a definite geometric form."

Under such a definition coal, limestone, and many other substances cannot be classed as minerals owing to their organic design. Therefore it is that Lord Fry's opinion, that "anything gotten from the earth for profit, or for the use of man", though possibly somewhat sweeping, is more acceptable than Geikie's, which is narrow, and possibly excludes coal, the greatest mineral of all.

IMPORTANCE OF MINERALS TO A COUNTRY

The question is asked, Have the people of the province, have the successive governments of the past fifty years, in anything like full measure realized the supreme importance her minerals are to the future of the province? Nowadays people look to governments to do for them some things they well might do themselves. In the matter of minerals, however, it is probably the part of governments to aid and give solid encouragement to their development for the reason that the royalties derived from their exploitation constitute a main source of revenue.

What, it may be asked, have our governments done in the way of aiding and calling attention to the province's mineral resources? Little comparatively has been done in the way of advertising. In 1898, and again in 1903, publications were issued, one by the government and the other under government patronage and material assistance, descriptive of our gold fields, and calling attention to other minerals. These were useful in their way, but they did not go far enough. Little, if anything, was said of the facilities for general exploitation of the many minerals. Nor were outsiders told what Nova Scotia was and where, and how they might come in and possess it. There are many people of countries not far distant who have the haziest idea of the province, and its many resources. That more information has not been widely distributed may be due to the peculiar economic theories of our rulers. Of course, all governments have had their difficulties. To expend a few thousand dollars on publications containing desirable information might appear to the members of non-mining counties, who constitute a majority in the legislature, as a piece of reckless extravagance. It has been claimed that ten per cent. of the royalties should be expended in efforts to make known what Nova Scotia possesses in the way of useful minerals. This, probably, is asking too much; a reasonable request might be that two per cent. of royalty revenues be expended in that direction, at intervals of, say, five to ten years. It would be money well and wisely spent. When our rulers get a fuller glimpse of the truth of the aphorism, "There is that witholdeth and it tendeth to poverty," we may hope for an unloosing of the purse strings. Other of the provinces, notably Ontario and British Columbia, have not been slow to make widely known what they have to offer. If Ontario, at the present time, can make a remarkable and attractive showing in the matter of mineral production, it is due in very large measure to a sensible and systematic propaganda. The Annual

Reports of the Department of Mines for Nova Scotia are, no doubt, instructive and interesting, but being largely statistical they may not be said to be arresting. As a rule, investors do not pore over pages relating to the geology of the country. What they want is information regarding the coal seams, the gold veins, the iron deposits, the silver, the copper, the antimony and other leads, and what is known of their extent and quality. Twenty thousand volumes containing such and other desirable information scattered broadcast in the principal marts of the world, would undoubtedly help in attracting to the province much needed capital. In short, capital should be told how and why it should come in to Nova Scotia. It need not be told the way out.

The suggestion of any liberal grant by the local government would likely, as has been hinted, be opposed by the members from agricultural districts, but not, it is pleasing to say, by all. A representative from a farming county said some time ago from his "place in the House" that: "The mineral interests of the province were of such paramount importance that he was of opinion that the Departmnet should be enlarged and its scope and efficiency for the development of the mineral resources of the province, made of a more up-to-date character. Everyone would admit that its mineral deposits were the chief source of wealth that this province possessed. He did not want to say a word against other industries, such as lumbering and the fisheries, but we must all come back to the fact that our mineral resources occupied the most prominent position and constituted the chief source of wealth of the province. It was our mineral wealth that differentiated us from some other of the provinces of the Dominion, and which, when properly developed, would give us the highest position in this respect among the provinces, not even excepting British Columbia.

. . . There were some who thought that the coal measures of Nova Scotia constituted our sole source of mineral wealth and it is true that they

are of almost illimitable value, but at the same time there were men in the province whose education and experience entitled their opinion to weight, who had no hesitation in saying we had, in this province, a mineral of even more value than our coal measures. He referred to the five thousand miles of gold bearing quartz. . . In looking over the history of gold mining in this province he found that gold was first discovered here in 1860 and that during the past forty odd years the industry had dragged out a fitful and spasmodic existence. Those who were best qualified to form an opinion had expressed the belief that the gold mining of the future that would pay best was that known as deep mining. Up to the present time that form of mining had not been developed here. The mining that had been done was carried on at shallow depths. . . . The province could never hope to take the position it should occupy until its advantages were properly advertised in the commercial centres of the world and capitalists were interested in the opportunities that were presented here for investment. We must let capitalists know what we had here before we could expect them to come in and assist in the development of our resources."

A year or two ago was published a statement by the head of our excellent Agricultural College which ran:—"We may talk of our mines and manufactures and fisheries as important industries, but, after all, the solid foundations of industries on which the permanent prosperity of Nova Scotia as well as other countries of the world must rest, is agriculture." Replying to this assertion the writer, in a paper read before the Nova Scotia Mining Society, among other things said:—

"The assertion that agriculture is the base of prosperity, and is the backbone of the province may be accepted without hesitation, perhaps, by a majority of the people as correct, and yet I am one of those who think that it is neither, wholly. I am, notwithstanding all the praise that has been bestow-

ed on farming, still of the opinion that not to her farms, or her forests or her fisheries must Nova Scotia turn if ever she aspires to become a populous and prosperous province of this great Dominion. In making this assertion it is not in my mind to weaken the faith of any in the importance of the farming, fishing and lumbering industries. These are all of great importance. Yet, while admitting it, I again venture to assert that if Nova Scotia is to have a grand and a great future, it must be brought about by the development of the vast—as yet incalculable—mineral wealth with which she has been so bountifully endowed. The statement that our province's greatest asset lies in her mines and minerals is met with the counter assertion—as I have stated—that farming is the backbone of the province. In a sense, of course, it is true, but it is not the whole truth, in the sense meant to be conveyed. No matter the consistency of one's backbone, he cannot hope to win out, if he be short of arm or feeble of limb. If by being the 'backbone' of the province it is meant to be conveyed that farming is and must remain its mainstay, I am inclined to demur. I venture the prediction that the time is coming quickly, when if, in Nova Scotia, farming can claim its thousands, mining and manufactures will claim their tens of thousands. The stars of farming, and forestry and fishing may not wane, most assuredly shall wax the star of mining, and if we are patriotic, if we really desire the welfare of our province, we cannot wish it otherwise. We speak of the civilized Western and benighted Eastern nations. When did the Western nations leave the darkness behind and emerge into the light? When they awoke to the fact that there were more far reaching purposes in life than peaceful pastoral pursuits. Why is it that Europe and America are greatly in advance, in civilization, of Asia and Africa? Is it not because the two last named continents rest almost wholly on an agricultural basis? Of the nations of Europe how is it that Spain and Portugal, Denmark and Holland

and even Italy play so unimportant a part in international politics? For a similar reason. Why is it that, in spite of emigration, Britain has, in a comparatively short period of time, added twenty millions to her population? Solely on account of industrial activity following on mineral development.

Why has Germany, in recent years, forged so rapidly to the front? Why is it that her emigration has decreased from 200,000 to about 30,000 persons a year? Why is it that in Germany wages have increased, in a short time, 25 per cent., while in some other European countries they are stationary, almost? Why has Germany become the second most important country as regards textile manufactures; the second as regards shipping, and the third in ship-building? Is it because, of late years, the labors of her husbandmen have been more abundantly blessed? No, because in the matter of mineral production she is no longer a back bencher; because in the matter of mineral, or to be precise, iron production, she has leaped to second place among the nations of the world. Will those, who assert that agriculture is the solid foundation on which the permanent prosperity of Nova Scotia and of the other countries of the world must rest, explain how it happens that notwithstanding the great decline in agriculture during the past half century Germany's prestige, prominence and prosperity has vastly increased? Fifty years ago the agriculturalists comprised half the population of Germany; now they number about a fourth of the whole, while the numbers engaged in mining, manufactures and other industries comprise two-fifths of the total."

(Since the foregoing was uttered how great must have been Germany's mineral development has been brought home to us by her astonishing exhibition of strength in the war still being waged. Had her minerals remained undeveloped she would have been easily forced to her knees long ago. Her mineral development is responsible for her wonderful resistance.)

Continuing, the author of the paper asked:—

"Is it due to the extent and fertility of her wheat and cotton fields, to the number engaged in tilling the soil, that the United States is to-day so great a country? Scarcely. Rather is it due to the fact that her peoples discovered that "there is a mine for silver and a place for gold where they find it; that iron is taken out of the rock and copper is molten out of stone." When the U. S. discovered, and profitted by the discovery, that nature's gifts, hidden in the ground, were as unlimited as those exposed on the surface, then did she shake herself, as a strong man awakening from sleep, then forged she to the front with amazing bounds.

"When Japan awoke to a realization of the significance of the words "Western civilization" her people became dominated with big desires and ardent longing, which pushed the nation forward, in one generation, beyond all the advances made in thousands of years. Not until Japan had familiarized herself with the white man's ways, and mastered the white man's methods did she really discover that mining and manufactures played the leading part in transforming a semi-barbaric horde into an energetic and civilized community.

"In answer to the question, 'What is Nova Scotia's greatest need'? there have been given as answers, 'More confidence in her resources'; 'More capital'; 'More intensive farming' and 'More population.' At the present time I will refer to the last answer—'population.'

"A writer in a Halifax paper, declared lately: 'Population is the keynote of the situation. . . . What Nova Scotia needs most of all is population, and indirectly that will benefit other unsatisfactory conditions. If there were 750,000 to 1,000,000 people in Nova Scotia, there would be better roads, more traffic for the railways, more trade for the business men. . . . Contractors, builders, farmers and machinists of all kinds require more population.' The statement, I think, is essentially correct, though

in some minor aspects, it may be open to discussion. While some of the older countries could at times, especially in such times as the present, dispense, with profit, perhaps, with numbers of their population, there is no gainsaying the statement that it is essential to the prosperity of a young country to have an ever increasing population. That being conceded the question to be answered is:—'How can the country secure population?' History, the experience of other countries, furnishes a prompt and reliable answer. The most powerful magnet, in attracting population to a country, is Mining.

"Let us step across the border line, and survey the U. S. What do we find? Just this, that the greatest and the wealthiest, and the most populous States of the Republic are not the purely agricultural ones, but those where mining and the industries that crowd in its wake, are most actively carried on. The four greatest States, according to wealth and population are New York, Pennsylvania, Illinois and Ohio. These four have within their borders, if I remember rightly, one fourth of the entire population of the greatest of republics. And, note well, these four greatest states owe their prominence not nearly so much to the farming as to the mining industry. Some members, of even mining society, while knowing that Pennsylvania, Illinois, and Ohio, are great coal mining states, may not have looked upon New York as, in any great degree, indebted to minerals for her prosperity. Will it surprise such when told that this state, unregarded as a mineral producer, takes no back place in mining, or if further told that the value of the minerals, metallic and non metallic, of the state of New York alone, equalled a year ago, the total of the production of all the minerals in the Dominion? How many have associated the state of New Jersey with mining, and yet that little state produces twice and a half times as much wealth, by mining, as does Nova Scotia, a province deemed to be underlaid, from end to end, with minerals. And, again, note well, that

success in mining was not attendant on progressive farming. It was almost all the other way. The United States practically owes the country west of the Mississippi to mining. It was the silver, and gold of Colorado and California that led to the inception of a transcontinental railway, and carried it successfully through wilderness and desert, and through and up and over mountains. But for the incentive, supplied by the presence of minerals, it is doubtful if there would be a transcontinental line. Indeed, it may be asserted, without fear of successful contradiction, that no industry opens up, and develops a country to the same extent, as mining. It, too, is a basal industry, and where there is mining there are dozens of dependant industries, and therefore it is that mining determines the chief centres of population. While the great Comstock lode was in operation, a modern city flourished in the centre of the Nevada desert; when mining stopped, there was again a desert; mining having again started, again is the desert being peopled.

It was the local market, and transportation facilities called forth by mining, that attracted agriculturists to Arizona and New Mexico and which has given them a living while they have been learning the science of dry farming, and turning waste places into fruitful farms. It was mining and the market it furnished, that prompted the idea of irrigating the dry belt of the west, and made possible the transforming of barren ground into productive gardens. Surely it was mining that opened up the mountain fastnesses of British Columbia, in whose valleys now are to be found a population, rapidly increasing, and industries rapidly expanding. Where, not so many years ago, were recognized nothing but rocks, are now to be seen some of the finest orchards, probably, in the world, and a fruit industry springing up which gives promise of becoming a leading factor in the future of that province.

"For years, for a decade at least, the Ontario government made heroic attempts to induce popula-

tion to settle on the clay belt at the head of Lake Temiskaming, in Northern Ontario. These efforts—including the inducements of transportation facilities—were all but fruitless until a time came when silver was discovered in that region, and the discovery of that mineral did more for Northern Ontario in a year than had been accomplished in all the years preceding. Cobalt settled the clay belt. To illustrate further the important part that mineral exploitation plays, in attracting population, let me instance a few cases. New Jersey doubled in population between 1870 and 1900; Illinois nearly did so, Ohio increased from two and a half to four millions; Pa. from 3½ to 6 millions, and New York from 4 to 7 millions. Massachusetts, the most important of the non-metallic states has $907,000,000 worth of manufactures, against $1,871,000,000 for New York, and $1,649,000,000 for Pa. From 1870 to 1900 were the years most prosperous in the life of the U. S. To what was the prosperity due? Primarily to the astonishing development of her mineral resources. While from 1870 to 1900 the corn crop increased from 1000 millions to 2000 million bushels, and wheat from 235 millions to 500 millions bushels, increases, respectively of 100 and 125 per cent., the production of coal increased, during the same period, 800 per cent.; pig iron also increased 800 per cent., and mineral oil 1200 per cent. These figures prove that to attract population, and to promote material prosperity, nothing serves so well as the development of a country's minerals.

"History bears me out in the assertion that without mineral production, industrial development is of slow growth, and without industrial development there is not, as a rule, any rapid growth of population. Without mineral production, industrial development, and a corresponding increase in population no nation can assume prominence or become a financial or a political power. The three greatest nations of the world are the three greatest coal producers, and the greatest iron manufacturers. These are

Britain, the United States, and Germany. Without coal and iron these three nations would not enjoy the distinction of being the foremost on the earth. To coal is due their industrial development and their commercial supremacy, and with all due deference to those who extol farming as the basis of Nova Scotia's future, I say, 'nay', her future, if it is to be one worthy of her endowments, lies in the development of her minerals."

Taking the United States as a whole, agriculture is the chief source of wealth. In this respect she differs from Britain. The value of the agricultural products of the Dominion as a whole may far outstrip the value of her minerals. Nova Scotia as a province must be judged on her merits, and her possibilities, just as the great mining states of America are judged, whose mineral wealth overshadows the agricultural wealth. Curiously, in the United States, as in Nova Scotia, the governments seem to have a warmer side for agriculture than for mining, as borne out by the following from a United States trade paper:—

MINING COMPARED WITH AGRICULTURE.

"The mining industry is the second industry in importance in the United States. It has a yearly production of more than two billion dollars as against nine billion claimed for agriculture. This comparison does not give justice to the mining industry, as in the nine billion output claimed by agriculture there are duplications which may reach as high as three or four billion dollars. The Department of Agriculture figures the value of the corn crop and then figures the value of the farm animals after the corn has been fed to them. The figures upon which the output of the mining industry is based, as a rule, show the value of the raw product at the mines.

"While the mining industry is the second in importance in this country, it is not generally under-

stood as such. The development of the mines came after agriculture, and as a result agriculture made its claims upon the Federal Government and the various State governments for aid many years before the mining industry. Agriculture as an industry is, therefore, better understood, better entrenched and better taken care of. The Federal Government altogether has appropriated nearly $24,000,000 a year for agriculture and the States approximately $11,000,000 more. The Federal Government is giving to the mining industry about $1,000,000 per year, and the States much less than this. In Congress, there are always a number of members who are ready at all times to champion the cause of agriculture. In Congress, there are very few men who understand anything about the mining industry. In Congress, membership on the Agriculture Committee is considered one of the honors. In Congress, the Committee on Mines and Mining goes begging for a chairman or for membership on the committee.

"The attitude of Congress generally toward the mining industry is in sharp contrast to the industry's importance in Great Britain. Membership on the Mines and Mining Committee in Parliament there is one of the highest honors that a member can receive. The best men are selected for this place, and a debate on the mining industry serves to bring forth the entire membership, and it becomes almost a national issue.

"Agriculture, with its strong organization and its general recognition throughout the country, has grown so rapidly in public favor and in the aid given by the Federal Government, that to-day it is the greatest subsidized industry on the face of the earth. For every $375 worth of product taken from the ground, the farmer received $1 of Federal aid. Add the State aid of $11,000,000 per year to this and you will readily see that no industry at any time has ever been subsidized to such extent. Agriculture is one of the industries of least hazard. The men

work out in the open air, under the bright sunlight, and under the most healthful conditions. The mining industry is one of the most hazardous known."

The writer deems this question of "Agriculture versus Mining" of so great importance, and so vital that our legislators clearly comprehend the situation, that he cannot forbear making a final quotation from the paper already freely quoted from:—

"Andrew Carnegie has said that capital, labor and brains may be compared to a three-legged stool; take away one leg and the stool tumbles. Were one inclined to be conciliatory, rather than correct, he might be willing to say of farming, mining and manufacturing that they are the three legs of a stool, the one valueless for its purpose without the other. But I cannot truthfully say so, with Britain before me to confound the illustration. Britain is a great country but not a great agricultural country. Granted that the loss of the little agriculture she has might cripple her, it would not crush her. Britain imports, in one year, five times in value the amount of food stuffs that she raises. Can it, then, be said that agriculture is the basis of her prosperity? And so I believe it will be with Nova Scotia. Farming must play a part; mining and manufactures the leading parts. Even if forced to admit that farming is the basis, the question remains "and what of the base without the pillars that support the commercial edifice?' The base is essential; the pillars give value to the base and are the more prominent. 'And Sampson said unto the lad that held him by the hand, Suffer me that I may feel the pillars whereupon the house standeth, that I may lean upon them. . . . . And Samson took hold of the two middle pillars **on which the house stood and on which it was borne up,** of the one with his right hand, and of the other with his left. . . . And he bowed himself with all his might and the house fell upon the lords and upon all the people.' The depression of the pillars meant disaster to the people; and I hold that any depression,—set back—to mining and

manufactures, the pillars of our trade, irrespective of the fact that the base remains—will bring disaster to the commercial prospects of our province. For a century prior to 1895 we had the, alleged, base of prosperity here with us in N. S., but the base itself did not prevent our young men, and fair maidens, leaving the old home and hieing to the new land. For the lack of population there was no home market, and for lack of a market the base became moss covered. We may talk of farming as the basis, and the back-bone, but without mining the base is of small value."

MINERAL LANDS: HOW SECURED.

It is somewhat unfortunate that the legislators of the early years of the province had not the foresight in giving "grants" of land to settlers, to reserve all minerals to the Crown. The minerals only considered of special value, such as coal and gold were reserved. In a number of cases, not even iron was among the reservations. In all grants of land subsequent to the year 1892 all minerals had been reserved. This detached and uncertain ownership of certain minerals has led to much annoyance and confusion, particularly on occasions of "booms." In certain counties, notably Antigonish and Guysboro, one taking out a right of search, say for iron, has to make sure, and that involves, probably, a search through the musty volumes in the Crown Lands Office, of the original grants that the Crown has the authority to grant the application. The Department of Mines has granted licenses when their right to do so was doubtful. It has caused vexation when one granted a right of search has found, when proceeding to make the needed arrangements for any damages that might be done to the surface of his land in prospecting, to discover that his right of search is valueless, that the minerals belong to the soil, and that he must arrange with the landlord for the minerals as well as for damages to the surface.

Again, in the case of shale, formerly considered of little or no value, but destined, let it be hoped, at no distant day to play an important part in the prosperity of the province, the prospector may discover that his right is of value only if the shale is of the kind classed as "bituminous," and of no value if it be of the kind called "carbonaceous." So far, the latter is claimed as belonging to the soil. Even the Mines Department has, if unofficially, made such pronouncement. In view of the uncertainty, and of the confusion arising therefrom, it is a little surprising the governments have not long ago declared that all minerals, for which, up to the date of the passing of an act by the legislature, there had been no application made, are the property of the Crown. This could not be held as an injustice, or in the nature of confiscation, at least not from a purely moral standpoint, for the reason that the recipients of the old grants did not consider that anything beyond the lands and the timber thereon were of any practical value. In fact the old grantees, it must be supposed, were of the belief that the government in reserving coal and gold had reserved the only minerals of value, if indeed there were minerals beyond these two in the province.

In a majority of cases, it may be taken for granted that all minerals belong to the crown. In every case coal and gold do. The following is the procedure to secure right to enter upon lands in search of, or take a lease for possession of minerals: When it is desired to search for coal or other minerals, except gold and silver, application is made to the Mines Department for a license to search, for which the sum of thirty dollars is payable. In the case of coal the applicant is granted the privilege, of course, if the land is not already covered, of searching over five square miles, during a period of eighteen month. He may take five rights over the five miles on payment of $150, thus securing himself against all intruders. Should he take out one right only he must apply for a lease at or before the

expiry of eighteen months, unless no other one in the interval has covered the same territory. If he has been the only applieant he may take out rights a seeond time. If, however, after eighteen months, he does not care to take out a lease, and yet to have the privilege of prospeeting, he ean apply for a right, over whieh others have secured a prior right of selcetion. In other words, he is given a fifth right. At any time during the tenure of a right the holder of it may seeure a lease of as many miles, up to five, as are not covered by right or lease. When an applieant knows he positively can loeate a mineral the better plan is to apply at onee for a lease. A lease costs fifty dollars, and in the case of coal, runs for eighty years, on a yearly rental of thirty dollars. This rental is remitted when the royalty on minerals produced, equals or exceeds that sum. The royalty on eoal is twelve and a half eents on all eoal produeed, less an allowanee of ten per cent. for wastage and, say, colliery eonsumption.

If gold or silver is the mineral sought after, applieation is made for a "prospecting lieense," good for twelve months, for whieh a fee of 50 cents is chargeable for an area measuring 250 feet in length, magnetic meridian north and south, and 150 feet east and west. Six areas at least must be applied for, and no lieense not eovering alluvial territory will be granted for a larger number than 100. Presumably, if 150 areas are wanted a second lease is granted for the excess of 100 areas. As in the case of coal, leases may be granted on uneovered ground on payment of two dollars an area. A lease for gold is for a term of 40 years.

Applications for minerals other than gold or silver are made in similar manner. A lease for coal or iron may cover a tract of ground not exceeding one square mile, and not exceeding two miles in length.

For the purpose of mining copper or lead a tract of ground not exceeding one half square mile, and not exceeding a mile in length. For the purpose of mining tin or precious stones a tract of ground, not

exceeding one quarter square mile and not exceeding one mile in length, and for the purpose of mining any other mineral a tract of ground of an extent and length to be determined by the Commissioner, but not exceeding half a square mile, and not exceeding one mile in length.

If, on investigation of the special circumstances, it is shown that from any natural cause, the tract of ground granted, as above, is insufficient to make a profitable mine, the tract may be extended, but in no case to exceed double the extent or double the length specified above in the individual cases. The prospector or lessee has, of course, to account in every case for any damage done to the property of the owner of the land. If no mutual agreement can be arrived at provision is made for arbitration, but as a rule the owners of the soil are pleased than otherwise over the coming of the prospector or the exploiter.

The royalties payable, at fixed terms, are as follows:—On coal, twelve and a half cents on a ton of 2,240 lbs.; on copper, four cents a unit, or one per cent. of copper on each ton of copper ore sold or smelted, of 2,240 lbs.; on lead, two cents upon every per centum of lead of 2,240 lbs. sold or smelted; on iron, five cents on every ton of 2,240 lbs. sold or smelted; on tin and precious stones and other minerals that are reserved, five per centum of their values. Leases may not now be held beyond a fixed period without bona fide work being done on the areas granted.

ORIGIN AND IMPORTANCE OF COAL.

Having stated in general terms what constitutes a mineral it may now be in order to narrate in detail the several useful minerals of which the province is the possessor, their characteristics and the purposes they serve.

Of all the minerals the province has been endowed with coal takes the premier place. Comparatively few people it is suggested have, with even their every day contact with coal in one way or another, begun fully to recognize the highly important part this mineral plays in modern life. There is nothing over, on, or above the earth's surface that equals, not to say transcends, it in importance and from which so many and diversified articles of commerce which play a momentous part in present day civilization can be extracted and utilized. Some of these shall be enumerated in subsequent articles. Meantime, let the topic be "What is Coal?"

A hundred years ago, or in or about Hugh Miller's time, the idea was clung to in many parts of Great Britain—one may not be able to deal with the idea prevalent in other countries—that the history of coal was coeval with that of creation, as so grandly described in the opening chapter of Genesis. It was then a common belief that, surely, coal was a creation, and not a formation through the action of the forces of nature continued through numberless years. At that time the common people had not been convincingly instructed by scientists that "a day" in Genesis was far other than our division into one of twenty-four hours. In many parts of Scotland—England might be belied if included—a century or so ago, the one who countered, when told that coal was beyond doubt a creation, was looked

upon by staunch presbyterians, who believed in no other kind of inspiration than verbal, as being as unorthodox as an Unitarian, and as soft-hearted as a Universalist. Hugh Miller, in his "Testimony of the Rocks," shook, if he did not shatter, many of the old time beliefs, and from that time coal, as a formation, became by slow degrees the common belief. Just why a gradual formation, an evolution, should not be considered as wonderful a thing as a creation is somewhat puzzling at times. To many the impression of every detail of a fern in a fossil creates a sense of keener awe and wonder, gives, so to speak, far deeper pause than does the study of a living fern leaf. How was coal formed? There were formerly varying opinions but these now have been resolved into one with, mayhap, diversity of opinion on one or more unimportant points. The characters of coals—there are several kinds,—are at times rather hard to define. This is proven by the fact that not only in Europe—not only in Scotland, as in the case of the Torbanehill mineral—but in certain of the American courts there has been important litigation involving the determination of "What is coal?" The word coal with us in Nova Scotia means bituminous coals. Coal shale is called simply shale, and yet if a court of law is called upon to declare the question, "What is shale?" the decision may be emphatically "Shale is coal." Such a declaration might, possibly, be correct, or again it might be erroneous. It all depends on what the shale was formed from, or of.

A simple division of coal has been made into two classes, namely, hard coal and soft coal. The former does not and the latter does flame, when kindled. For this reason some esteem soft coal more highly, for a grate fire, than its statlier and less frolicsome associate. No head was ever turned "biggin'" castles in the air as he sat gazing into an anthracite fire, while many a fairy, or giant castle has been reared, by elderly folk as well as bairns, as they mused, lost to all else surrounding, watching, half

unknowingly, the "fuffing" flames.

If one consults a dictionary as to "What is coal?" he is dismissed somewhat summarily with the bald statement that "coal is a mineralized vegetable substance." The definition is not, probably, quite correct, for there are coals that have not their origin in decayed or mineralized vegetable matter. The Albertite "coal" of New Brunswick, for instance, is alleged not to be from stems and leaves, but from various kinds of fish, and there is no doubt that many of the oil producing shales, not characterized as coal in this instance—of the province, have similar origin. Tersely put, however, there are but two really distinct kinds of coal, hard and soft, or bituminous and anthracite. Anthracite contains from, say, 85 to 95 per cent of carbon, and bituminous from 50 to 75 per cent. The coals having more than 75 and not more than 85 per cent. of carbon may, possibly, be put in the semi-anthracite class.

It is a matter of mere conjecture at what time coal came into use. It does not seem to have been utilized by the ancients, though some declare that the ancient Britons had some idea of its value. It was in consumption—it is stated by one somewhat authoratively—in Europe in the ninth century. Others maintain that it did not come into use until the twelfth or thirteenth centuries. These declare that of the European nations England and Scotland were the first to use it, while another dogmatically affirms that it was in use in Germany a century or more before it found favor in England and Scotland. Take yet another opinion which seems fairly reasonable :

"Coal was known to the Romans, and there are traces in some of their buildings in Northumberland that they used it for fuel. But in the old days the forests supplied plenty of wood; there was little demand for fires for the purpose of manufactures; houses were small and men did not need so much warming as they do at present; chimneys to carry off the smoke were almost unknown, and coal was

not very greatly in demand. It began, however, to be sent to London where it was gradually used by smiths and brewers, who needed fires for their trades. In 1305 Parliament complained to Edward I that the burning of coal corrupted the air by its smoke and harmful vapors. An order was made that those who used coal should be punished, and their furnaces destroyed. However, coal was still used in spite of this order, and gradually became more common. In the sixteenth century the population in the south of England greatly increased; trade developed rapidly, the woods had gradually been cleared away, and fuel became more difficult to get. In the reign of Elizabeth coal crept from the forge to the kitchen and the hall. Houses were larger and better built, chimneys were common, whereas formerly, not more than two or three were to be seen in ordinary towns. The coal trade along the Tyne became brisk, and in 1615 four hundred ships were employed in carrying coals from the harbour of Newcastle. Let the quid nuncs fight it out among themselves. The ordinary man is satisfied with the knowledge that it is in use now, that its tremendous value has been keenly brought home to all within late years, and that it is now held to be one of the most important of all the indispensible requisites.

As to the origin of coal there are certain and extended learned theories. One of these, in vogue sixty or more years ago, was that the amazingly luxurious vegetation, including mammoth trees, to which pundits give names as hard to get around as their alleged trees must have been hard to encircle, which prevailed during the Carboniferous Age, decayed on land slightly higher than the sea level. In process of time, and by very slow degrees, these layers of rotted matter sank below sea level, and then by great upheavals rose out of the water. Again were they covered with dense masses of plants, again sunk and so the process went on, forest and stream continually "fighting it out." Afterwards, when a truce had been called, thick masses of stratified mat-

ter aeeumulated, producing great pressure, and this with ehemieal .ehanges gradually mineralized the vegetable matter, the resultant being Coal.

That was the prevailing view for long. It might be unwise to thrust it aside altogether, as it appeals mueh more to those who esteem of more valuc highly speculative scientific opinions, than plain, praetical and eommon sense views, on what, after all ,is somewhat of a problem. The writer is of those who hold to the view, whieh has secured very many adherents during recent years, that it was not neeessary that there should have been what is implied in the words "luxurious vegetation," in the formation of coal. Coal was undoubtedly at one time wood, perhaps of shrubs, or bushy plants, such as heather. After deeay these formed peat, then by compression and expulsion of gases, the peat became lignite. A eontinuance of this operation and bituminous eoal was the result, and a still further continuance with inereasing pressure and anthracite is formed. Large wood is not neeessary to the formation of peat, and peat is the basis of coal. It is now assumed by many that instead of being eomposed of heavy wood coal had its origin in bushy and somewhat dwarf growth. Those who have travelled over peat bogs or peat lands, or better who have witnessed the operation of turf or peat cutting, as it is done in Ireland and Scotland, must have notieed that the top layer, say a foot in depth, is open, light in eolor, and spongy. The stems of the plants, not yet fully decayed, of the thiekness of a knitting needle to a clay pipe stem, ean be readily drawn out of the peats, whieh are of the size of an ordinary brick. A foot below, the peat is less open, loses some of its turfy appearance, and is of a darker eolor. The deeper the operation goes the grain becomes eloser, the color darker, the peat more eompact and heavier, though not so compact as coal, as it is still swollen with water. Peats made from the top layer may easily be torn asunder by hand, from the second layer not so easily, while from the bottom layer they ean be broken only by the

application of more or less force. Time and pressure, combined with chemical action, are the two things alone necessary to transform peat into coal. This opinion is persisted in by numbers in face of the fact that solemn declaration has been made, that at a certain point off the coast of France, the process of coal formation from a submerged forest of wood of large growth can be witnessed. Decaying wood may be seen, but not any coal forming, for in the formation of the coal known to us it is necessary that there be strata and there will be no strata there, at least not in our day. By the way it is further contended there must have been wood of very heavy growth before coal was formed, else how comes it that "pots," petrified parts of trees of large diameter, are found in coal seams. The answer is that "pots" are not found in coal seams, but in the immediately overlying strata formed ages after the vegetable matter had decayed, and who knows what capers nature had played in the interval. These "pots" are either the remains of solitary trees, petrified, which grew among the smaller herbage; or trees, or parts of trees, that were carried by floods, from other territory, by the "floods" alleged to play a prominent part in coal formation, into that of the smaller plants. Solitary trees can frequently be seen at longer or shorter intervals in peat lands, appearing like sentinels on guard, trees which grew there possibly from a seed or a spore wafted by the wind from a distant forest, just as thistledown is carried from Prince Edward Island, across the dividing waters to Nova Scotia.

Fire, too, possibly played a part in coal formation. The writer handled a charred stem of wood, about eight inches in length and of the thickness of an ornamental walking cane, taken from the middle of a lump of coal mined at the Black Diamond Colliery, Westville, Pictou County.

The foregoing embodies the writer's ideas as to the origin of coal, but they are not, possibly, in conformity with the views of certified geologists, and

their opinions, as a matter of course, take precedence of those of a layman. It is not politic to be too "sot," to use an Americanism, on any particular opinion. Some are rightly less concerned as to the theory of the formation as to the fact that coal exists in abundance in the province. For all that we are not done with theories. The foregoing remarks may be a trifle prosy for some readers. If a more poetical and ornate description of the origin of coal is demanded, why, then, take an author who, luckily for himself—and unfortunately for the genuine wits to be met with in certain mining districts, grimy and dull though their surroundings may be—cannot at present be located:—

"Of the falling autumn leaf glorious in crimson and gold, the wind and the rain and the tramping hoof, leaving a weak but a black smudge—that is carbon.

"Before man trod the earth, while yet the mammoth lizard led creation's van, in the wet and nitrogen laden atmosphere, grew dense forms of giant ferns, and trees, leaf, and branch and stem fallen decillions through the millions of years, formed peat-like bogs, from which gases well, while the carbon remained and hardened as it sank. Primeval forces hurled the ocean upon the land covering the carbon beds with salt and sand, became shale and stone. Upon the land exhumed again great forests grew to be likewise covered by the ocean or Glacial drift. Thus during vast cycles was formed the alternate layers of coal and slate and stone, the greater the pressure the less of gas and the more of carbon remains within. The cold peat becomes lignite; the lignite was pressed into cannel; the cannel is compacted into bituminous; beneath the mighty crash of mountains turns bituminous to anthracite. These differing kinds of coal being due in part to the quality of the original vegetation, and the decillions caused by subterraneous gases, and over and again cooling earth, shrinks and shrivels, wrinkling the layers of coal and slate and stone into furrows of

hill and valley, the anticlinal crest and synclinal trough.''

At the conclusion of the transcript the inclination was to mutter ''By George,'' or some other pressure relieving phrase. Of course, like ordinary poets, the author of the extract eschews logic. If pressure is responsible for making peat into lignite and so on, then the character of the vegetation may have something to do with the quality of each individual coal, but not with the ''kind'' of coal.

To relieve the monotony of long writing, one sitting near was asked to listen. After the extract had been read and not knowing that it was a borrowed description, the listener exclaimed, while a frown covered the face, ''For pity's sake don't publish that, else readers will say you are 'pretty far left to yourself,' '' which is the politest way yet discovered of conveying to one that he is bordering on a state of lunacy. On being told that the matter read was not original, but an extract, a smile displaced the frown. The extract conveys one bit of information. The statement as to layers of salt and sand explains why the borers for oil in Cape Breton threw their caps in the air when from out the bore hole poured a stream of brine. Readers may form an adequate idea of what the author of the extract intended to convey. The writer is free to confess that the particular brand of rhapsody is beyond him. The poet, or his stenographer, were careless of punctuation, and the proof-reader feared to take liberties. It is not, however, to be expected that any one who thinks in decillions, can express himself with that coherence necessary to impress people whose minds become confused when trillions, a mere fraction of decillions, are mentioned.

Professor Huxley and others demonstrated that in many instances the bitumen matter in coal is formed wholly of the spore cases and spores of plants allied to club mosses, ferns and so forth.

The following table shows that wood, peat, lignite and true coal indicate by their composition the

changes which vegetable matter undergoes by decay and pressure. Many data could be given to show how gradually these substances pass into each other.

	Wood.	Peat.	Lignite.	Coal.
Carbon	50	60	65.7	82.6
Hydrogen ..	62	65	53	56
Oxygen	43.8	33.5	29	11.8

In passing from one grade to another the proportion of oxygen and hydrogen decreases, these substances being given off in the form of marsh gas and carbonic acid in the progress of decay.

ADDED IMPORTANCE OF COAL.

It is probable that not one individual in ten, of the inhabitants of a country, not one in five even of those whose present and future is more or less bound up with the production of coal, has anything like a full or clear conception of the wonderful, indeed it may be said, of the marvellous part coal has played, is playing, in the greatest war the world ever saw. Some know that coal supplies power that makes transportation of huge bodies of men, munitions and guns possible, who know little or nothing of the part it plays in the manufacture of the deadliest explosives. Said one in an address lately, "There was a time—and it is only a century since—when practically the one thing needed for an army was food. When the lord on the hill wanted to fight his rival, to take a slice of his territory away, he had to concern himself with having a certain number of fighting men, and then with supplying them with food. War is now an industrial game; and the foundation of industry, as we know it now, is coal. And so it is that you are at the very root and foundation of the great war industry. Unless we have an abundance, or at least a sufficiency, of coal, war cannot be carried on."

Some flippantly may say, "Oh, yes, we realize fully that it has grown in importance from its increased cost." It is possible that some judge of its value only by its increased price, and yet coal must not be valued by the price it costs. One cannot arrive at the true value of coal by what it costs in the market. Coal is the agent that makes possible the industrial development of our province, just as it underlies the prosperity of the most advanced countries in the world, at the present time. If Nova Scotia, as it is hoped, is to become really the workshop of our great Dominion, then factories, work-

shops, steel and steel shipbuilding plants, will be made possible by the province's extensive coal areas. All industries and extensive transportation, by sea and by land, must flourish and in their steady expansion add prosperity and comforts to the people, through the motive power furnished by what must be looked upon as a possession of incalculable value —our coal areas.

Speaking of the added importance of coal—as applied to Nova Scotia—Mr. D. H. McDougall, General Manager of the Dominion Steel Corporation, which includes Dominion Coal, in his presidential address at the last annual meeting (1917) of the Canadian Mining Institute, among other things, said :—

"Nova Scotia coal at the present time and throughout the whole course of the war, has been used for war purposes, some of which may be briefly enumerated.

"The St. Lawrence patrol, and the large auxiliary cruisers in North Atlantic waters have used Nova Scotia coal, and, in addition a never ending stream of transatlantic transports sailing from the various ports of Eastern Canada. The railways from Montreal east, conveying troops and material for shipment to Europe have used our coal as their motive power. At the various steel and munition works in Nova Scotia our coal seams have supplied the coal for the manufacture of shells of every calibre, barbed wire for entanglements, nails and other steel products used in war, or, it would be more proper to say, used in this war. Large quantities of tuluol, the base of the most widely used explosive in this war have been distilled in Nova Scotia. Sulphate of ammonia, a most necessary and valuable article in agriculture, is another of our coal products that has assumed increased importance in these days of food shortage It is hardly an exaggeration to say that, with the exception of the domestic use of coal in the Maritime Provinces and Newfoundland, almost the whole of the coal produced in Nova Scotia is being used directly or indirectly for the prosecution of the

war.

"It has needed this war to demonstrate the value of coal in another way, that is, as the equivalent of gold as a medium of commercial exchange, and a stabilizer of currency. The financial strength of Great Britain, which is the wonder and the admiration of the world, has been much assisted by her ability to export coal, in addition to keeping her own fires burning. It has been a most helpful factor in maintaining British credit and the purchasing value of the pound sterling. . . . . .

"If we follow the course of the war, we shall see that the action of the German and Austrian armies, and later, the action of their Turkish and Bulgarian allies, was directed by a desire on the part of our enemies to obtain control of the coal and iron fields of Europe, and of that other important source of motive power, petroleum. This is a fact so patent and obvious that it is unnecessary for me to do more than mention it. The successful strategy of our own armies is at the present time quite evidently actuated by a determination to recover the coal fields of Northern France. . . . .

"As coal is the basis of all modern manufacturing industries it follows that the greatest efficiency of industries is obtained when they are located in the coal fields, thereby eliminating as a factor of expense unnecessary transportation. Although from the immediate view point of the coal operators, the loss of the Montreal market may present a serious problem, yet from the larger viewpoint of Canada's national effieiency and certainly from the view point of the province of Nova Scotia, there is a good deal to be said for a greater concentration of manufacturing activities within the coal fields of Nova Scotia. The transportation of millions of tons of coal, by water and by rail, to be used in the manufacturing industries of large centres of population, such as Montreal and Boston, is not really an effieient and economically sound proceeding."

Much more remains to be said in reference to the

added importance of coal in late years through the many bye-products it yields, and through the many and diversified uses to which these are being applied not only in the arts of war, but more extensively in those of peace. In later chapters it is proposed to divert attention to a number of these varied bye-products, so important and so wonderful. The mineral, however, from which these marvellous bye-products are derived necessarily claims first attention.

The wonderful part now played by coal is well illustrated in the following extract from a United States mining magazine:—

"A study of the value of the mineral products of the different states will afford a great surprise to most persons. It is natural to think of gold and silver as the most prominent representatives of mineral wealth, and yet the production of Colorado and California annually represents a value of only about $100,000,000, while the coal of Pennsylvania, at points of distribution, yields a revenue approximating $600,000,000. More than this the market value of coal, great as it is, is not by any means its proper measure of value. Coal is the power that underlies the industrial supremacy of Pennsylvania. The countless factories and workshops, the innumerable locomotives drawing their rich burdens of commodities, the steamboats that ply in our rivers, all exist and flourish, and constantly add to the prosperity and happiness of the people, through the motive power furnished by the most prosaic, but at the same time the most useful of minerals—coal. The prosperity of the state is assured as long as the great demand for coal continues ,for the use of coal means activity among the manufacturing and transportation interests, employment of labor, and, presumably, profit to the employer."

Pennsylvania is all but an inland state, and yet coal has made her great, and what it has done for Pennsylvania it should do for Nova Scotia, with its splendid geographical position.

NOVA SCOTIA'S COAL AREAS.

"Nova Scotia is richly endowed with coal."
—Sir J. W. Dawson.

In the text books, one and all, of the years immediately succeeding confederation, it was declared that there were three coal producing provinces in the Dominion. At first blush one might think this was a misstatement, but technically it was correct. The North-west Territory was not till a subsequent period formed or divided, into provinces. One of these provinces is, possibly, destined at no distant day to become the chief coal producer in the Dominion. The three provinces mentioned as producers of coal were, Nova Scotia, New Brunswick and British Columbia. There are those who do not endorse the inclusion of New Brunswick, and give as a reason the smallness of its production. These argue after this fashion: Grapes are grown in Nova Scotia, and yet it might be stretching a bit to class the province as a producer of grapes, when comparison is made with Ontario. Well, in such a sense, New Brunswick cannot well lay claim to be a coal producer even though for possibly seventy-five years a little coal mining has been carried fitfully on. Including the Yukon there are at the present time six coal producing provinces. Nova Scotia was the first portion of the Dominion to engage in coal mining, which began, say, a century and a quarter ago, and to-day she leads in production. This first place she may retain for some years to come, but the time is at hand when she may have to resign chief place in favor of Alberta. And yet it may be otherwise. Twenty-five or more years ago it was predicted that in a very few years British Columbia would forge ahead of Nova Scotia, but the prediction failed.

Nova Scotia is still the leader and this place she may retain for years, due to her advantageous geographical position, with its winter ports.

The Province of Nova Scotia has an area of 21,428 square miles, and had a population, in 1911, of 492,338 or about 23 persons to the square mile. It juts from the east coast of North America, easterly, and lies diagonally between latitudes 43 and 47 north. It is about 320 miles long by about 100 miles wide, and is a continuation of the Appalachian Mountain range, which extends along the east coast of the continent, and which range is now incorrectly called the Allegheny. Appalachian is the Spanish name given to these mountains by De Soto, after the Indians of that name. The Province is part of the continent called by Dawson the "Acadian Region."

Nova Scotia is, undoubtedly, rich in coal. The estimated number of tons in situ in 1914 was 8,730,000,000, distributed as follows:—

Cape Breton County	.....	5,664,268,000
Pictou ,,	.....	1,324,076,000
Cumberland ,,	.....	845,544,000
Victoria ,,	.....	14,112,000
Inverness ,,	.....	882,000,000

In addition to this, which many hold to be a very conservative estimate—there are others who are satisfied to place the figures at a thousand million tons less—there are the great undersea seams, which have ben proved to be valuable for at least two miles oceanward, and there is no reason to think other than that valuable seams lie for many miles to the eastward under the sea.

Previous to the year 1763 coal was not reserved. After that, between the years 1763 and 1767, it was reserved, except in a few cases All coal is now reserved.

At Glengarry, in Cape Breton County, a seam of coal, four feet thick, has, it is declared, been discovered, but the development has not been sufficient on which to base a calculation of the amount of coal in the basin.

In Antigonish, Richmond and Colchester Coun-

ties, a number of leases have been taken for coal lands, and exploratory work is now being carried on in the first named but, as at Glengarry, the data are not sufficient to assist in a calculation of the quantity of coal that may be contained in these areas.

Up to January, 1915, there were 1,143 square miles of coal area leased in the Province, 50 square miles of which had been mined in.

The valuable coal seams lie in the Middle Carboniferous system, in a series of basinlike formations. The coal basins formed along the east coast of Cape Breton contain some valuable seams of coal ranging in thickness from two to nine feet. This section is known as the Sydney Coal Field. The strata throughout are almost free from faults or disturbances, which renders the veins regular and persistent. The seams have an easy dip seaward, of about one foot in ten or eleven feet, except the Victoria seam at Low Point, which dips at a much greater angle. This coal field extends 35 miles along the coast from Big Bras d'Or Gut to the head of Cow Bay, and comprises a land area of 200 square miles; it reaches inland from five to six miles. The coal lies in four basins, known as the Cow Bay, Glace Bay, Lingan and Bras d'Or basins. There are excellent exposures of the coals of this district in the banks of the several bays on the eastern coast of Cape Breton from Bras d'Or to Mira.

This coal field produces about four-fifths of the total output of the Province. The whole field is underlaid by the Millstone Grit to a thickness of 1,800 feet. The measures over the coals are strong, rendering them safe to work at shallow depths.

On the western side of Cape Breton Island lies the Inverness coal field. It extends about 50 miles north from Port Hood to Chimney Corner. Some valuable seams have been opened in this district. Like the Sydney coal field, it is divided into four basins; the Port Hood, Mabou, Inverness and Chimney Corner.

In the early 70's a mine was opened at Chimney Corner. A number of workmen's houses were built and a good start was made to develop the seams in that region; but in 1873 a fire occurred that burnt the bankhead and destroyed the machinery and since that time nothing, except a little prospecting, has been done in that section of the Inverness coal field.

A bore-hole put down at St. Rose, near Chimney Corner, in 1904, found a seam of bright coal four feet thick, at 89 feet, and a seam of eight feet at 285 feet. These coals are of good quality and the facilities for mining them are as good as anywhere in the Province. With railway connection to Bras d'Or lake, excellent shipping sites can be obtained.

The Port Hood and Richmond Coal and Railway Co.'s mine at Port Hood, and the Mabou and Gulf Coal Co.'s mine at Mabou, have been flooded for these last seven or eight years, and now the only mine in operation in the Inverness field is the Inverness mine, owned by the Inverness Railway and Coal Co. This mine produced 278,821 tons in the fiscal year ended September 30th, 1916. There are a number of large and undeveloped coal seams in the flooded districts that are awaiting courage and capital only in order to become producers. It is not possible that these splendid areas will long go begging for somebody to take hold.

The Pictou coal field has an area of about 35 square miles and contains some of the thickest seams in the world. This district has been producing for nearly 100 years. Like the other coals of the Province, the principal beds lie in the Middle Carboniferous series. East of New Glasgow, and toward Little Harbor, the Upper Carboniferous comes in, but the seams of coal thus far discovered in this section are of minor importance.

In the Pictou coal field proper, the strata are much faulted and the structure is intricate. Disturbances of much magnitude have been numerous, and the productive measures appear to be entirely encircled

by them. In no other part of the Province have the geologists, great and small, had occasion to so often revise their knowledge concerning the positions and locations of the coal seams, and in no other part of the continent have they been so often in error. The Great McCulloch Fault that was as real to Pictou coal men as was the old Foord Pit pump-beam, has disappeared, and in fact some authorities are bold enough to tell us that it never has existed. Seams of coal that were surely running in a certain direction, have been discovered going in an altogether different direction. Recent borings have brought very many new and undreamt of seams of coal to light. The recent opening of a coal seam near Thorburn by the Greenwood Coal Co. has shown that our geologists were in error even in that section of the coal field. All these developments have so changed the opinions of men interested in coal mines in Pictou County that it appears to be in order now for some person to guess anew the geological mysteries in the Pictou coal field.

In Cumberland County lie coal beds from which the Joggins and the Springhill mines have won millions of tons and in which millions of tons remain. The seams in the Joggins area occur on one side of a synclinal basin of carboniferous measures, which toward the center of the basin is overlapped by the Permian beds. In the western part of this district the seams are thin, except the Joggins, which is about 5 feet thick. The measures in this section dip south-west. In the strata exposed along the shore of Chignecto Bay there are more than 70 coal seams shown. Several of these are about 5½ feet thick. One is 9½ feet, but has shale parting aggregating 2½ feet.

In the Springhill basin which lies about 15 miles east of the Joggins basin, the structure is not so simple, and the strata dip at about 30 degrees. There are a number of seams in this basin some of which are 10 feet thick and have been producing regularly for 40 years.

The following seams of coal have been mined:

Cape Breton County.

Phalen	6 to 8	feet			thick
Hub	4	feet	5	inches	„
Harbor	5	„	6	„	„
Emery	4	„	6	„	„
Victoria	6	„	6	„	„
Lingan	5	„	6	„	„
Block House	8	„	0	„	„
MacAulay	5	„	3	„	„
South Head	3	„	4	„	„
Tracey	5	„	0	„	„
Sydney Main	5	„	6	„	„
Lloyds	6	„	9	„	„
Sydney No. 3	4	„	0	„	„
Collins	4	„	9	„	„

Victoria County.

New Campbellton	4	„	0	„	„

Inverness County.

Inverness	7	„	0	„	„
Port Hood	7	„	0	„	„
Mabou	7	„	0	„	„
Chimney Corner	6	„	0	„	„

Pictou County.

Foord	25 to 40	feet „
Cage	13	„ „
Third Seam	12	„ „
Stellar do. (coal oil)	4	„ „
McGregor	14	„ „
Acadia	15	„ „
Scott	15	„ „
Nos. 4 and 5	8 to 12	„ „
Vale	3½ to 7	„ „
McBean	6	„ „
Marsh	4	„ „

Cumberland County.

Springhill No. 2					8	„	„
Springhill No. 3	4 to 8	feet	3	inches		„	
Joggins	4	„	5	„		„	
Minudie	2	„	9	„		„	
Hardscrable	2	„	9	„		„	
Chigneeto	6	„	0	„		„	
Kimberley							

The seams operated by the Dominion Coal Co. are: the Phalen, Hub, Harbor, Emery, McAulay, Lingan and the Victoria.

The seams operated by the Nova Scotia Steel and Coal Co. are: the Sydney Main, Lloyd's and No. 3.

The Bras d' Or Coal Co. are operating in the Collins and Sydney No. 3.

The Inverness Coal Co. gets its produet from the Inverness seams (two).

The Aeadia Coal Co. are mining in the Foord, Cage, McGregor and Third seams.

The Intercolonial Coal Mining Co. are working the Acadia, Main, Seeond, Fourth and Fifth Seams.

The Milford Coal Co. are operating in the Marsh seam.

The Greenwood Coal Co. find their product in one of the Thorburn seams.

The Dominion Coal Co., Springhill, are working the three seams at Springhill.

The Maritime Coal, Railway and Power Co. are producing from the Joggins and other seams.

The Minudie Coal Co. is operating in the Minudie district.

A further reference to the McCulloch Brook Fault may not be displeasing, as there are many laymen

who rejoice when the assertions of the scientists do not tally with ascertained facts. It may be asked why the belief was general a score or so years ago that there was a big interruption in the Drummond colliery main seam. The answer is simple. Many years ago geologists, including the foremost in the land, such as Sir William Dawson, asserted unhesitatingly, just as if stating a positive and proven fact, as if indeed they had been privileged to peer into the depths, that the coal in the Drummond Mine in the near vicinity of Westville was cut completely off by a fault, at what is known as the McCulloch Brook. It was asserted that soon as the Brook was reached there would be no coal found beyond. The brook, through process of time, was reached, by the underground development work done, and still there was coal, and no sign of faulty interruption. What then had the geologists to say? The one thing left them was to move back the position indicated in the original plan. The fault was there, no doubt, though its exact position may have been not quite correctly indicated, and the plan underwent correction accordingly, the "plotters" asserting that the fault was in hiding, only for a time. Down went the slope and on went the levels, and further—on the plan—back went the fault, for the eminent and somewhat dazed geologists were not wholly discomfited, and were still, though staggered, enamored of their long time belief. A quarter of a mile past the alleged fault, coal; a third of a mile past, still coal; a half a mile past, and the coal still persistent and bright as ever. After the half mile had been passed the geologists wisely concluded that it might not be expedient to tamper further with the plan, but let the fault stay where they last placed it, for, out of what seemed to them pure deviltry, the coal persisted on going down and on challenging the fault to interrupt its progress. The last occasion on which the writer had the privilege of a talk with the late well-loved Hugh Fletcher, he in playful mood asked if there had been any news as to the

latest escapade of "that fault." Hugh, loyal to his profession, smilingly said: "It may yet be met with." When the main slope of the Drummond colliery was abandoned, as a precautionary measure against fire, the fault had not been encountered. The general opinion now is that the seam reaches and possibly crosses under the East River. As it is development work, before the closing of the slope, had nearly reached the river.

QUALITY OF NOVA SCOTIA COAL.

The idea prevailed for a long time in the minds of many in the province and beyond, that the coals of the province were not of the best quality, and were used, so to speak, on sufferance. This for long was not only the opinion of the common people, but of those deemed to be authorities, and assented to, in a way, by even some of the operators. If a merchant expresses the opinion, no matter what his motive in the so doing, that his wares are not of so quite high quality as those obtainable at distant points, people are apt to believe him, because they cannot imagine a man playfully, or for a purpose, disparaging his own goods. If some people have no high opinion of provincial coal it is, curiously, due in large part to the fact that persons, formerly engaged in coal mining, had themselves believed what producers in other countries had said. The opinion of outsiders had been too readily accepted without any reasonable investigation. This is probably a statement hard to understand or believe, and yet it is true. There were, some twenty years or more ago, some among the coal operators who contended that had the coals of the province free admission to the markets of the United States we could not secure a footing there, owing to the lower quality of our coal. Also that free coal into Canada meant the submerging of our coal trade by the inflow of the superior coals of Britain. There are, no doubt, kinds of British, and United States coal, superior for special

purposes to those of the province, but for general purposes, Nova Scotia coal can hold its own with the run of coal of other countries. It is somewhat curious that the best vindication of the quality of Nova Scotia coals has come from those who may be termed aliens. From two important and unlooked for sources there came, previous to 1914—there have been daily practical and pointed certificates since—certificates as to quality which places Nova Scotia coal among the best produced. In one of the volumes (Vol. XIV) of the Transactions of the American Institute of Mining Engineers, occur the following remarks:—

"The quality of the coal of the Pittsburg region, especially of the Pittsburg bed, is A No. 1 in the scale of marketable coals of the world. This is not said in the way of any odious comparison. There are coals in other parts of the world equal to it in every respect. The coal, for example ,of the "Hub" seam of the Glace Bay Colliery (Dominion Coal Coy. is meant), in Eastern Cape Breton, is quite like it in every feature. The semblance between that mine and mines on the Monongahela and Youghigeny rivers are almost ridiculous. The bed is of the same thickness, the plies are arranged the same way, the chemical analysis is identical, and the mining operations are conducted on the same plan, so that a shipment of that particular kind of Cape Breton coal and a shipment of Pittsburg coal laid on the same wharf could not be distinguished from each other."

Some time ago exhaustive tests were made at the Gas Works, Manchester, New Hampshire, of two large quantities each of Cape Breton and American coals. The American coals selected were those considered best as gas producers. The following are the results of the tests, certified to by the chief chemist of the Gas Engineering Coy. of Pa.

	Vol. Com. Matter.	Fixed Carbon.	Ash.	Sulphur.
Dom. No. 2 ..	38.91	55.03	6.06	1.38
American ...	38.50	55.27	6.13	1.38

These tests, be it noted, were not analyses of small quantities of selected coal, but were exhaustive, extending over ten days, during which time several thousand tons of each kind of coal were utilized. This test establishes that, as between high-priced American gas coal and the coal of Cape Breton, there is not a fiftieth part of a dollar's difference, the one way or the other.

Following are analyses of several of the seams in three countries. The analyses of Inverness County coals are omitted as tests of some of the districts, not in active operation at present, are not available. It may be sufficient to say that the coal at Inverness is rated high for domestic uses and there is a seam at Mabou that has not its superior for metallurgical purposes.

The following shows an average analysis of the Nova Scotia coals :—

Cape Breton coal :	
Moisture	0.75
Volatile matter	37.26
Fixed Carbon	58.74
Ash	3.25
Pictou coals :	
Moisture	1.19
Volatile matter	29.10
Fixed Carbon	60.63
Ash	9.34
Cumberland coals :	
Moisture	1.46
Volatile matter	33.69
Fixed Carbon	59.35
Ash	5.50

COAL TRADE EXPANSION.

James Watt's mother thought her boy a visionary, displaying few of the eharaeteristies that presaged the development of the lad to a "man o' parts," to use a phrase eurrent in Seotland. There were few lads, of fifty of more years ago, who were not familiar with the tradition whieh told of how the boy Watt stood before the spout of the boiling kettle, and eounted the drops of water falling into the spoon, as the steam eondensed. It was, possibly, repetitions of this proeeeding whieh caused his mother to have doubts of the future praetieal usefulness of her boy. Another ineident in Watt's young life is not, possibly, so well known. The young lad, on an oeeasion, was lying stretehed out on the floor of the kitehen, the hearthstone, a slab of slate—immediately in front of him. With a pieee of ehalk the boy was drawing what his mother thought were uneanny pietures, and making foolish ealeulations. The mother looked at the boy half amusedly and half pityingly, and remarked to the boy's grandfather: "I fear he will never be other than a dreamer or an idler," or words of similar import. Replied the grandfather, who was wise, more far sighted and more sympathetie, "Let the laddie be, he has more in his head that you give him credit for." And he had.

Coal, to a limited extent, was used in industries fifty years or more before Watt's time, but it was only used as a substitute for wood, or when other

fuels were too expensive. The diseovery of the power of steam, the invention of the steam engine, with the general use of coal as a fuel, eaused a revolution in industry. In faet the discovery of the steam engine, and the part coal played in its adop tion, had a pronounced effect on all progress, all eivilization that followed. That lives of men in all countries where civilization is established, have been beneficially affected by coal is not questioned. Have not those who have written of the characteristies of the peoples of the different nations told us that where there is no winter fireside, where men have not, like the ants, to lay in stores of food and other neeessaries against the rigors of winter, there is no advaneed civilization, indeed cannot well be. It is told that the one thing a century or so ago that an army needed was food. No doubt that was a primary requisite at times. Why at times only? Because when the clans were a real institution in Scotland, food was not a prime necessity, when the clansmen went forth to battle. In truth there would have been fewer fierce fights between the elans if the chief of each had had ample store of food in his larder. On many occasions, when his clan was short of food, did the pibroch sound summoning a clan to go forth to forage for food and fodder, the command being not so much to eapture the opposing clansmen as to earry away their cattle. The great war of the nations has demonstrated that present day warfare is an industrial game; and on all sides it is admitted that the foundation of the great industries is coal. Without abundant supplies of coal war as it is now earried on would be an impossibility. There would be no monster guns, because there would be no powerful and suffieiently effective explosives with which to feed them. It is to be hoped that wars over all the world will soon eease, and therefore all are more deeply interested in the expansion of industries in which coal, in spite of all competitors, is bound to play the leading part, and that whether it is used as at present, in open

furnaces, in closed retorts on the surface, or, as some predict, converted in the mine, by scientific processes yet to be discovered, into gases suitable for all purposes for which it is presently employed.

On the American continent the expansion of the coal trade has been phenomenal. The time when the coal trade of the United States amounted to a few million tons only is within the memory of many living. Not so many years ago Britain led the world in coal production. That place she had to surrender to the United States a comparatively few years ago, and now the production of the United States almost dwarfs that of Britain. The question however that should interest Nova Scotians most is "What of our provincial coal trade. Has it expanded as its people had expected or could wish?" There are those who express contentment, if not whole-hearted satisfaction; and others whose disappointment is more or less pronounced. The average increase is approximately ten per cent, and this increase, it will be noted, is consistent. The decade 1841-1850 was the first to go easily over the million ton mark. Here are the figures for the seven decades 1841-1910 and the six years, 1911-1916:—1841-1850, 1,533,000; 1851-1860, 2,399,000; 1861-1870, 4,927,000; 1871-1880, 7,377,000; 1881-1890, 13,900,000; 1891-1900, 20,522-000; 1901-1910, 45,898,000 and 1911-1916, 36,068,000 tons, the odd figures in each instance omitted. It will be noticed that the most satisfactory increases occur in the three last decades. The percentage of increase may show no great difference between these and the three decades preceding, but it must not be overlooked that an increase from 2,400,000 in the decade 1851-1860 to 4,930,000 in that of 1861-1870, and from 4,930,000 to 7,377,000 tons in the subsequent decade is evidence of greater progress in the later than in the earlier decades. Taking the increases for the several decades, as presented in the table, and basing thereon what is frequently spoken of as the "natural" increase—ten per cent. per annum—it might be safe to assume that the decade ending

1920, had there been no interruption due to the war, while not maintaining the natural increase, would show as great an increase, in tons, as the decade ending 1910 showed over its predecessor; in other words that an increase of 25,000,000 tons would have to be placed to its credit. The war precludes the idea, not only of anything like the natural increase, but even endangers the realization of half the natural increase—five per cent. Satisfactory, on the whole, as Nova Scotia's coal trade expansion has been, it falls much short of the predictions made some years ago—more particularly after the advent of the Dominion Coal Coy.—by more than one prominent politician. In say, 1898, after it had been demonstrated that the Dominion Coal Coy. would make a success of the undertaking, it was freely predicted—and as freely believed—that in ten years, that is to say by 1908, the production of that company alone would be ten million tons yearly. The prophets of the late 'nineties, while big hearted, were not, to the regret of all, foresighted. Those, even, who were adjudged to be very conservative in expressing opinions as to future happenings, were impelled at times to throw off reserve and make stimulating predictions. Optimism was, it may be said, general, and yet some were not to be carried off their feet. One of these was the late H. S. Poole, who was, as was before him his father, closely connected with the coal trade. He was induced by a publication to give its readers his views on the outlook for the coal trade. Giving way to persuasion, he wrote a short article, remarkable for its caution. He was not to be drawn into any big prediction, but was content to say, in substance, that if all went well, the Cape Breton collieries "might" be producing nine million tons by the year 1925. Though the past three years have been more or less of a disappointment; though there are those of a pessimistic tint—a tint tending always to grey—who declare that it will be years before the Cape Breton output again reaches the 1913 high water mark, there are others whose outlook is cheer-

ier, and declare that Mr. Poole took no chances in his estimate of what the future is likely to show, and that his figures will likely be reached before the time set has elapsed.

Nova Scotia, being a not unimportant province in the Dominion, is supposed to secure a fair share of any trade expansion that takes place. There are many who are disappointed that the general industrial expansion in Canada, during the past three years and more has not been participated in by the coal trade of the province. This conclusion seems to be borne out by the largely increased coal consumption on the one, and the decreased coal production in Nova Scotia on the other hand. Judged by the coal importations into Canada during, notably, the past three years, the expansion in the general industries of Canada must have been very large, and rapid. In round figures the coal importations into Canada from the United States were three years ago seven odd million tons, of bituminous coal, used principally for power purposes. Last year the importations were about doubled. Deducting two million tons as the lessened shipments of Nova Scotia coal to the St. Lawrence last year, the increase in importations would have reached in the past two years, five million tons—into the country west of Montreal, or—speaking more precisely—into Ontario.

Nova Scotia may be responsible for two million tons of the seven million ton increase, due to lessened production, which in its turn was due chiefly to the large number of miners who went overseas. When enlistments began in 1914 the recruiting officers had splendid fields for operations in the mining districts. The government, having an eye to the future, should have discouraged recruiting at the collieries. The government were, however, no more short sighted than the great majority of the people. The evil is done, and concern should be for the future. What should the government do? That is a big question. One thing that may be suggested is that the instant peace is proclaimed, the first to go on board the

transports should be the men who were drawn from the farms and the mines. People must first of all be fed, and then it must be seen to that the trade which produces the power that sets the wheels of industries in motion, should not suffer from lack of labor, nor for loss of ships, and other modern means of transportation. The first batches must be sent back quickly, so as to prepare places for those to follow, because development work at the mines is not now proceeding, due to scarcity of labor.

If the expansion of the coal trade is to progress as rapidly as it should, then, it must receive equal attention with the other provinces at the hands of the federal authorities. In some way or other Nova Scotia must be given easy access to the biggest of the provinces—Ontario. If from an economic standpoint coal cannot be carried by rail, then it must find its way by water. Many are ready to demand that the canals and waterways connecting with the Great Lakes, be so deepened as to permit of navigation by ocean-going steamers; and, or the locks in the canals be so extended to make possible the passing through of long craft of light draft. The people of Nova Scotia may, in the near future, say to the authorities at Ottawa, "If this province is to receive the benefits anticipated from the federation of the several provinces, then we ask that you find a way for our coal into Ontario." Indeed they may brusquely say, "Find a way or make it." "Coal Mining in Nova Scotia will be dealt with in a subsequent chapter.

There may be, however, a little consolation for those who deem it a matter of regret that the coal trade balance is so much against Canada, and so largely in favor of the United States, a regret probably somewhat intensified by the knowledge that, within the past twenty years, it has been discovered that besides N. S., with its Atlantic seaboard, and B. C., bounded, in large part, by the Pacific Ocean, each having abundant coal resources, there are vast coal deposits in other Western provinces. The consola-

tion is that this regret is no new complaint, but one of long standing. Forty-four years ago the Nova Scotia Inspector of Mines in his report to the Commissioners, conveyed disappointment in the following short sentence.

"It will be observed that while the United States exports into Canada were 428,455 tons of coal, they imported from us but 269,000 tons."

By "us," of course, is meant Nova Scotia alone. If to have a balance of trade against it is a bad thing for a country, then "Canada"—Canada and the British North American provinces were interchangeable terms before Canfederation—is in a much worse plight to-day. In 1872 and 1873 the United States took a fourth of the production of the Nova Scotia mines, while last year, 1917, it took but a twenty-fourth part, combining bituminous and anthracite importations. From the United States last year was taken a quantity double the production of all the collieries within Canada's vast boundaries. The United States has become all but independent of Nova Scotia, while Canada, of late years, has become more and more of a patron of the United States. Indeed it may be said that Canada, in larger part than ever, has become dependent for her fuel supply on the United States, but, let it be added, not wholly of necessity. As already hinted there is no need that such dependence continue. Nova Scotia sent last year (1917) half the quantity only she sent in 1873, while the United States sent thirty-three times as much as in that year. There is no occasion to regret Nova Scotia's diminished sales in the United States. The regret is that the United States is doing so greatly increased business, largely at Nova Scotia's expense. The province has a rapidly growing local market, and she should be enabled to supply a larger share of the "home" market, which, of course, includes the provinces east of Manitoba.

As stated less coal was sent from Nova Scotia to the United States than 45 years ago, and yet a majority of the people were in no wise affected, although,

at one time, it was the common belief that the United States was Nova Scotia's natural, and therefore, chief and only promising market, and without which Nova Scotia's coal trade would be of slow expansion. It is possible that no coal of the character sent in 1872-3, which was "round" coal, was exported to the United States in 1917. That sent was slack, of which, it seems, one or two of the collieries making "domestic" coal, have at times a surplus.

Nova Scotia sent in 1916 to three of the neighbouring provinces, Quebec, New Brunswick and P. E. I. 2,725,000 tons as against 320,000 supplied in 1873. In 1897 the shipments to the three provinces named were, in round figures, 1,180,000 and in 1914, when they reached their highest point, 3,156,000 tons.

The local sales in 1897 were 641,000 tons, and in 1916 2,800,000 tons.

The sales to the three provinces in 1906 were 2,240,000 tons. In 1914, the best year, they reached 3,156,000 tons an increase of 916,000 in eight years.

The local sales in 1906 were 962,000 tons, ten years later they reached 2,826,000. To sum up the market in the three provinces has increased some 2,037,-000 tons, and the local market during a similar period 2,200,000, close running with the odds in favor of the local market. For the desired expansion of the coal trade of the province, many are disposed to look to the local rather than to any market outside the province, and the writer looks also in that direction.

IRON ORE.

It has been well said that a nation's defences are in her hills, for in them are stored her iron ore, which the strong arms of her sons bring forth, and the genius of her people converts into great engines, it may be of war, in the shape of mighty steel super-dreadnaughts, or it may be into massive bridges spanning majestic rivers, or powerful locomotives that hasten hither and thither moving endless trains of passengers and property. The nation that possesses coal and iron possesses twin giants that enable it to assume a foremost position among the great nations of the earth. The great nations, each of them, owe their supremacy to that which is dug out of the earth or blasted out of the mountains.

Gold may be looked upon as the most precious of metals, and yet, coal and iron are really the more valuable and necessary.

Is the question asked? Is a ton of steel as valuable as a ton of gold? The answer must be, Yes, and in fact more valuable. Work the ton of gold into articles of beautiful and artistic design, and its value is not increased more than two fold, while the ton of steel worked into millions of watch springs is worth twice the value of the wrought gold.

The nations that have contributed most to the wonderful development of the past hundred years, the nations that have felled the forests, and made paths and highways through the deserts; the nations that have contributed most to the establishment of

the numerous and varied industries of the present day, and to the strides of civilization, are those nations that have placed on King Coal a crown of iron. So, then, Canada, if she is to become, and play a conspicuous part as a great nation; and so too of Nova Scotia if she is to attain, as told us, a commanding position in our vast Dominion, must secure that position through her coal mines and blast furnaces. With abundance of coal, with iron at her doors, if not within her own territory, in almost inexhaustible quantities, with deposits, beyond doubt, of minerals of many kinds, Nova Scotians may be justified in holding to the belief that our province, whose shores are laved by the waters of the great Atlantic, is sure to become the future workshop of the Dominion.

The sentiments expressed above were lightly esteemed on this side the water, say a hundred years ago. For instance, a century or so ago, Daniel Webster, that acknowledged to be big brained man, said: "If we had an ignorant starving population we might set up for iron workers against the world." To-day, were he with us, the great man might be drawing a wry face over his lack of foresight. Time has so changed conditions that the iron industry has proven to be the foundation stone in the prosperity of great nations. The iron industry, which had no position then, has now a fabulous output.

The subject of this chapter is one beset with difficulties. When to speak out and when to be silent is somewhat perplexing. The writer incidentally mentioned to one who had done a large amount of prospecting that he was preparing articles on the several minerals of Nova Scotia and that how to handle the iron ore question, without being thrust out of the synagogue and stoned perplexed him greatly. There came a reply which did not help out of the dilemma. He said, "For my part and from my experience, I do not see how you can become exuberantly enthusiastic over the iron ores of the province. You have demanded the extreme optimists to furnish proofs as

to extent and quality. Keep up demanding."

Up till a few years ago the general belief was that Nova Scotia had abundance of iron ore of the best quality. This opinion was held, without the slightest hesitation, for a long period of time. This belief was founded on what has been declared by geologists of the highest standing. In a work published by Sir William Fairbairn in 1862 the declaration was made that "in Nova Scotia some of the finest iron ores yet discovered occur in boundless abundance." Possibly taking his cue from what Fairbairn had said, coupled with reports received by the Nova Scotia Mines Department, another geologist, of no mean standing, made the somewhat startling statement that "there is more iron ore in Nova Scotia than there is coal to smelt it with." One who was acknowledged to be an authority made the assertion, not so many years ago, when referring to reported deposits of iron in Inverness County, that "there was five times as much ore in the vicinity of Whycocomagh as in the whole of Belle Isle Island,"which is to-day one of the most extensive deposits on the American continent, indeed it may be said, of any proved deposit of any country.

The late Dr. Bell, for whom it was claimed that he had made a study of Nova Scotia ore lands, expressed his opinion as follows: "The statement that there is in Nova Scotia an unlimited quantity of iron ore of any variety and quality, is warranted by the facts. The ores are magnetic, hematites of several varieties, limonites, strathese and bog ores. They extend along the Cobequid Mountains, and the Annapolis Valley, uniting in the vicinity of Truro, pass through Pictou, Antigonish and Guysboro counties to the Strait of Canso. The Torbrook (Annapolis county) deposits are excellent ores. In the Island of Cape Breton enough work has been done to show that there are numerous deposits, important from their size and quality."

Mr. Jennison, a Nova Scotia mining engineer, is not quite so unrestricted in his endorsements either

as to quantity or to quality. He is content to say:—

The iron ores of Nova Scotia are not confined to any particular geological horizon, but may be found in almost any. In fifteen out of the eighteen counties of the province iron ore and indications of iron deposits, may be found. Many of them are just sufficient to tempt, and not reward. Others have been proved to be valuable. There are many districts which show favorable indications, well worthy of further investigation, and are yet to be tested. There are three districts which are valuable, Londonderry, East River and Nictaux."

The Attorney General of Nova Scotia at the time what is known as the "Whitney legislation" was being discussed in the House of Assembly, from his place referred to a mineral which Nova Scotia had in large abundance, a mineral which was the twin sister of coal, and of paramount importance to the future of the Province. He quoted a high official of the Mines Department as his authority for saying the Province had boundless stores of iron ore, and in his concluding sentence said:—

"I expect to see great capitalists coming to other counties of the Province and building blast furnaces and taking hold of the iron industries of Nova Scotia so that in a few years our young men may see Nova Scotia not at a standstill, or a little province of 400,000 people, but the very centre of the industrial life of this Dominion of which it is a part."

One interested in the iron ores of Annapolis County, and who formed one of a delegation who had a conference with the government on assistance to iron ore mining, said, "We have a magnificent heritage in our iron ore deposits. I believe the south mountain is one mass of iron ore, and there are many other equally valuable deposits, but how are we to develop these if our hands are tied from lack of labor."

The Geological Survey of Canada, which never grows enthusiastic over any particular mineral, its quantity and quality, was content to express the

opinion that Nova Seotia possessed from the knowledge obtainable, large deposits of the important mineral. From this opinion it was not diverted till within a year or two baek. In the last Report of the Survey, whieh the writer has read, the partial retraction is made that the quantity is not panning out as predieted, or words exaetly to that effect.

Had one said to a mineralogist looking for a job, two or three years ago, "Go seareh for me the reeords of the Nova Seotia Mines Department, and those of the Canadian Geologieal Survey, eonsult with prospeetors who assert they have diseovered large deposits of iron, and then eome and tell of all that you have gleaned. The following, likely, would be a not unfair summary of his report:—

"Iron ore is widely distributed in the geologieal formation of Nova Seotia. Nearly all the provinee exeept the southern part, earries iron ore. Small deposits dot the shores of the Bay of Fundy from Briar Island to Cape Split, and on the south shore of Cobequid Bay toward Truro. South of the former line of deposits are the more important ones of Clementsport and Nietaux. There are many small iron deposits on the north side of Minas Basin, and there is, probably, a eonneeted line of ore from the Cobequid Mountains running east into Pietou County. East of Pietou, in Guysboro County, deposits oeeur north of the granites, and the gold bearing measures. At Arisaig, Antigonish County, there is a large deposit near the shore of Northumberland Strait. At Gleneoe, in Inverness County, the Dominion Iron and Steel Coy. has done extensive prospeeting and opened up several deposits. There is a limatite deposit at Whyeoeomagh and at Barachois, Cape Breton County. The ores between Pietou and the Strait of Canso have been worked at Bridgeville, Pietou County, Arisaig, Antigonish County, and in the Roman Valley, Guysboro County. The ores of the Province are near tidewater, fuel and flux. In the Nietaux and Torbrook deposits mixed hematite

and magnetic gave from over two hundred analyses, 20 to 54 per cent. iron. These veins run from 1.5 to 10 feet thick and many shipments have been made from them. Operations ceased in 1913. The total output from the Torbrook district is estimated at a little over a quarter million tons. The best areas are known as the Leckie, which is hematite, and the shell vein, which is magnetic. These veins have been opened up for a considerable distance, over at least a mile."

Analyses of the ores of Londonderry, which are hematite, show 57 per cent. iron. This deposit has been worked at different times since 1849 and has poduced about two million tons. Operations ceased here some years ago. The ore-bed at Brookfield is limonite, in lenticular deposits. These deposits are about 300 feet long and ranging in width from 30 to 80 feet. About 45,000 tons have been mined. The ores of Arisaig are hematite and give from 24 to 52 per cent. iron. The richest part being about one and a quarter mile from the shore. It begins at Malignant Cove and continues for five miles along the shore south-westerly and is in extent 1,000 by 15,000 feet. A bed of hematite three feet thick has been exposed at the Arisaig pier. The amount of ore that was mined in Antigonish County is not known.

At Barachois on the Bras d'Or lakes, there is a deposit of hematite, 22 miles from Sydney, which gives on analysis from 33 to 55 per cent. iron. This ore lies in good position for cheap transportation. The vein is of good regular quality and is from one to three feet thick.

The Whycocomagh hematite averages a yield from analysis of 56 per cent. iron. The most important deposit is at Skye Mountain, and is the only one, so far, that warrants development. These ore pockets have never been developed sufficiently to prove their contents. No iron has been mined in this or any other district for several years. Here is a table showing the counties in which iron ore is found, the kind of ore, and the per cent. of metallic iron by

analyses."

Counties	Kind of Ore	Per cent. Iron.
Guysborough	Specular Hematite Hematite	55 to 62
Annapolis	Hematite Magnetite	33 to 62
Hants	Limonite Hematite	35 to 61
Cumberland	Hematite Siderite	
Colchester	Limonite Siderite	28.5 to 59
Pictou	Specular Hematite Hematite	46 to 65
Antigonish	Hematite Magnetite	60
Inverness	Magnetite Hematite	43 to 65.5
Victoria	Magnetite Specular Hematite	43 to 62.5
Cape Breton	Magnetite Hematite Specular Hematite Siderite	58 to 65

Asked where he had gathered his information he may have replied, "From all available likely sources."

In face of these several quoted opinions of savants and scientists what is one who cannot speak as one having authority, to do? What dare he say and still have regard for any reputation for veracity he may have acquired or been accorded?

The answer from a disinterested one may be

"let them say what they say stick to your guns." That supposed advice shall be followed.

First of all let the extreme optimists be dealt with gently. A little over four years ago in a sketch of the development and present operation in the Iron and Steel Industry of Nova Scotia, Mr. C. L. Cantley, mining engineer, and one well versed in geology as affecting the search for iron ore, and who may be classed among the younger prophets says, in part:

"In general it may be said that the iron ore resources of Nova Scotia have proved disappointing, in view of the many evidences of wide-spread existence of iron oxide. Moreover, with one possible exception, no deposit of the extent, or containing ore of the necessary quality to warrant the establishment of, or to sustain, a modern iron and steel industry has yet been found in the province. By this statement it is not intended to assert that merchantable ore does not exist, or that such as are known cannot be economically mined. Nor would the writer imply that ore cannot be mined on a small scale and sold profitably in the markets of the world."

The writer has, for probably twenty years, declared that the needed proof is lacking, not only as to the quantity but the quality, from the then and present, commercial standpoint. Up till a comparatively short time he was constrained to admit that there was iron ore at Nictaux, fairly satisfactory both as to quantity and quality. Of course he did not, as some did, make exaggeration on either point. The province was advised a score of years ago, in a publication whose author was said to be in touch with parties willing to exploit the iron ores of the province, that "A recognized and disinterested authority has studied the Nictaux deposits and remarks of parts of them that prospecting work done shows a tract underlain by say 300,000,000 million tons of iron ore. This large body of ore ought to be developed but it is not. There is no inducement to invest the capital needed to make the beds productive, while foreign ore comes into the home market duty

free, and direct state aid, to the iron miners, calculated to effect so serious a handicap, is withheld.''

Possibly just such exaggerated statements as contained in the above extract led many to take a little more interest in the iron ores of the Province. At least it had that effect on the writer with the result that the more he followed the subject the less sanguine as to the extent and quality of even the Annapolis ores, he became. And those most deeply interested, too, seem to have become less pleased the more development work was accomplished. Six years ago the owners of the Nictaux property made rail connection with the Central Railway, built a washer on the Nictaux River, constructed large shipping plant, with conveyors, etc., affording evidence of the intention to operate the deposits on a large scale. Only one or two cargoes, however, were shipped and shortly after work was discontinued and nothing has been done for years. Were the operators disappointed as to quantity or to quality? There is good ore at Annapolis running as high as 55 per cent. and there is poor ore running down to 35 per cent. Can it be that the estimate as to probable quantity has not been borne out, as development work extended.

Turn next to the second of the districts favored by the geologists and others—Londonderry. Work has been suspended there for years, and the understood reason is that while there are deposits, larger and smaller, here and there, the trouble and expense in connection with their exploration is a ban to operation at the present time.

There remains the third favored district, the East River of Pictou County. On the strength of what the geologists had said, and the results of a somewhat incomplete investigation a blast furnace was erected at Ferrona. For a time there was a sufficient, if somewhat spasmodic supply. The company not only carried on ore mining on its own leases, but was ready to take ore, from wherever drawn, on a basis for so much per unit of iron in the ore. All was unavailing. For some ten years the product of

Pictou County had to be augmented by supplies from Wabana. It has been said that, not only in connection with the ores of East River, but those of other parts of the Province, the owners of the blast furnace favored Wabana at their expense. There is no foundation for such a belief. Without having been informed, or having asked for the reasons for removing the furnace to Sydney Mines, the writer has little hesitation in asserting that had it not been for the assistance Wabana rendered in supplementing the short supply of Pictou ores, the furnace at Eureka would have been damped out years before its abandonment From these several disappointments, it may not be correct to style them wholly discouragements, must the conclusion be come to, that iron ore does not exist in anything like the abundance or of the quality spoken of by eminent geologists. They may still be right in the assertion that ore abounds, though exploitation has proven them to be wrong as to localities, where it was held to be in largest quantity, and of richest quality. If all the deposits known to exist could be placed in close contiguity to each other they would form a pile that would incite to enthusiasm. It is the lack of continuity in the deposits that have been prospected that chills one's optimism. And, yet, in spite of the demonstration that many of the alleged large deposits are so many indifferent pockets, there are many ready to assert that those who question the extent and richness of the ore, in many localities, are knockers, pure and simple, whose loyalty to the province, and its hoped for future, is of a dubious character. The assertion can well be taken exception to. True loyalty demands that there shall be no dissemination of greatly exaggerated opinions as to the mineral resources of the province, more especially as regards so highly important a mineral as iron ore. Should these opinions induce capitalists to come in and exploit the province's ore lands, and their efforts end in disappointment, then injury to the Province must follow. Their disappointment they

communieate to others, possibly to some who intended to invade the Province to look into deposits of other minerals, really possessed by the province. Their intentions are never carried out, because they say to themselves, "If the statements in referenee to the abundanee of iron ore were not warranted, those in referenee to this, or that, other mineral may be unwarranted also." Sueeessive governments have been blamed for not giving assistanee to the iron ore miner. Loeal governments are meant. The possibility is that believing what geologists, big and little, had said they were not impressed by appeals for assistanee. And, possibly too, they may have been inelined to say, "The eoal trade has got along very well without material assistanee, indeed the coal trade has assisted the governments. Let this question be put and left to readers for answer. The provinee has coal, and the eoal trade has made fairly satisfactory progress; it is alleged, on all sides, that the provinee has abundance of iron ore, why, then, has the province no native iron ore trade?

Mueh remains to be said. It is inadvisable to prolong a subjeet until it becomes tiresome. Further reference may be made in a succeeding ehapter dealing with Iron Ore Mining.

GYPSUM (Sulphate of Lime)

Nova Scotia has abundance in gypsum, generally of a pure quality. Unfortunately it is not subject to royalty. A glance at the geological map readily shows that the Carboniferous System in this Province lies in the Counties of Cumberland, Colchester, Hants, Pictou, Antigonish, Victoria, Cape Breton and Richmond, and as it is the home of the gypsiferous deposits, these counties contain immense quantities of gypsum.

In the territory lying between Minudie and Pugwash, there are large deposits, especially at Maccan River and at Pugwash. In Hants County, it is quarried near Windsor in the outcrop of an immense vein. It is quarried at Newport, Cheverie, Walton and Noel in the same county. At Pictou it is found in workable quantities on the East River. In Antigonish it is exposed, in one place on the shore, for a height of 200 feet. The bed of gypsum from which Plaster Cove, now Port Hastings, took its name, is of enormous thickness two-thirds of which is anhydrite or hard gypsum. Near the mouth of Mabou River there is another large deposit. A peculiarity of the gypsum in this vicinity is that it crops alongside the coal, which would indicate that the coal here is in the Lower Carboniferous series. Gypsum appears again at Chcticamp, and is quarried and manufactured into plaster at Eastern Harbor. It is found in many places along the Margaree River and at Lake Ainslie. It abounds at Big Harbor on the

Bras d'Or Lake and at St. Ann's, where the Victoria Gypsum Mining and Manufacturing Co. have been quarrying gypsum for years. Here is the only gypsum mine in the Province. Another deposit is being worked at Ottawa Brook by the Newark Lime and Cement Co., and at Lennox Passage in Richmond County there is a large bed of exeellent gypsum. In Cape Breton County there are large deposits, but they have not been worked to any extent.

The surfaees of all these beds of gypsum are marked by inverted eone-shaped eavities known as "plaster pits" or "kettle holes." In some plaees they are not exposed, exeept the tops; and gypsum beds may be traeed by these where there is no outeropping.

These eavities are formed, some geologists say, by the solvent aetion of the surfaee water penetrating the fissuers of the gypsum. Other authorities say that kettle holes are formed by eseaping gases. These eavities are more eontraeted in the anhydrite or "hard plaster."

Gypsum is divided, in a general way into two elasses, soft and anhydrous. The latter kind is gypsum destitute of the eombined moisture whieh gives it its usefulness for modeling and plastering, and is known to the quarrymen as "hard roek." It ean not be bored with the same augers as the "soft rock," whieh is almost chemieally pure and whieh is broken with pieks with little trouble. There is no market for anhydrous gypsum. It should make a good base for paved streets, and might be a good substitute for marble for indoor deeoration.

Gypsum when ealeined beeomes Plaster of Paris. When heated to 250 Fahrenheit it loses its water of eombination and beeomes anhydrous. The transparent varieties are known as selenite. The increase in the production of gypsum is about proportional to the inerease in the building trades, the manufaeture of eement and other purposes for whieh white gypsum is used. The quantity is easily far in excess of the demand for many years to eome.

The grey and blue varieties are used for cement and agriculture and are available for many years. The total gypsiferous area is about 75.5 square miles. It has been quarried in the Province for more than one hundred years. During the years from 1861 to 1867 twenty-five ports in Nova Scotia were shipping gypsum from twelve counties; in 1908 six ports were shipping from three counties. The business is largely prosecuted by United States capital, except the works at Chetieamp and at Iona, which are owned in the Province.

The quantity produced has gradually increased from 52,460 tons in 1883 to 271,609 tons in 1913. In 1912 the production was 333,385 tons. In 1914 it decreased to 283,340 tons and in 1915 it was 233,216 tons.

The average price from 1883 to 1897 was 75 cents a ton. In 1908, 500,000 tons sold in Canada at $1.25 a ton, which is about the price now at the shipping piers in Nova Scotia.

Plaster from gypsum is made at Windsor, Cheticamp and Iona. About 5,000 tons of finished plaster was produced in 1915; the remainder of the product was shipped to the United States, New York and Pennsylvania being the largest importers.

The following companies were operating in the Province in the fiscal year ended September 30th, 1915, and produced 233,216 tons of gypsum:—

Victoria Gypsum Co. St. Ann's Victoria County. Production 32,157 tons; employed 125 men.

Iona Gypsum Co., Iona, Victoria County; production 2,579 tons finished plaster; employed 20 men.

Newark Lime and Cement Co., Ottawa Brook, Inverness County; production 400 tons, employed 20 men. Most of the year this company was building a railroad to a larger deposit about two miles farther west.

The Newport Gypsum Co., Avondale, Hants County. Production 31,461 tons with an average force of 50 men.

Wentworth Gypsum Co., Wentworth, Hants

County. Production 129,319 tons and employed an average of 138 men.

Patterson Quarry, Kempt Shore, Hants County. Production 2,500 tons and employed 12 men.

The Walton Quarries Co., Walton, Hants County. Production 17,800 tons and from the Cheverie Quarry 18,000 tons.

The production of gypsum for the fiscal year ended September 30th, 1916 was 297,400 tons, an increase over the production of the previous year.

DIATOMACEOUS EARTH.

This material known under the names of "tripolite," "tripoli," and "infusorial earth," is a pulverulent substanee, white when pure, but often having a brownish discoloration. Deposits are common in lakes and swamps in many parts of Nova Scotia. It is rarely pure and usually is mixed with earbonate of lime and magnesia, elay and other substances, the silica contents varying between 75 and 90 per eent.

The following is eondensed from an artiele in the Annual Report of the Geologieal Survey, eontributed some years ago:—

"Diatomaeeous earth is very porous, the speeific gravity being 0.25 to 0.30, owing to the numerous interstitial spaees and air eavities between the spicules and shells and within the latter, giving lightness and great absorbent power.

The uses to whieh diatomaeeous earth is put are very varied and are probably eapable of greater extension. Formerly, it was widely used in the manufaeture of dynamite as an absorbent of the nitro-glyeerine, its porosity, whieh allows of its absorbing liquids to the extent of four to five times its own weight, rendering it eminently adapted to that purpose. But in this conneetion it has been wholly replaced by eheaper absorbents sueh as wood pulp, sawdust, ete. At present its ehief use is as a polishing material, the grains being sharp and eutting, but fine enough not to scratch metal surfaces; it is also used as a boiler covering, its porosity rendering it a

good non-conductor of heat. It can be used in the manufacture of bricks when great lightness is required, but owing to the difficulty of manufacture, these bricks are costly and cannot on that account be used for ordinary purposes. Such bricks can be made of one quarter the weight of ordinary bricks. Diatomaceous earth is also used to some extent in the manufacture of certain soaps, and as filtering material, etc."

The most important deposits discovered up to that time were in Nova Scotia and New Brunswick. In Nova Scotia it is found in the following places:—

Folly Lake, Cumberland County. The deposit at this place is the largest yet known in the province. It occupies the bed and shores of Folly Lake. The lake has an area of over 200 acres, two-thirds of which are probably covered with this deposit. Its surface is 600 feet above sea level. The deposit has been worked to a small extent for the manufacture of polishing material, and for use as a non-conductor of heat.

Fountain Lake, Cumberland County. A valuable deposit of tripolite has been found at this place. It occupies the bed of the lake which is on the road to River Philip, Westchester Mountain. It is of remarkable purity and the lake is said to be easy to drain. It is eight miles distant from Minas Basin at Port-au-Pic, and about the same distance from the Intercolonial Railway. The deposit is worked to a small extent. Other deposits of less extent occur in the numerous lakes of this region.

Upper Barney's River, Pictou County. In 1886 four tons of infusorial earth were shipped from a deposit at Alex. Sutherland's, in a marsh. The extent of the deposit is not known. The marsh is 50 yards wide and of indefinite length. The deposit is two feet thick and immediately under the sod.

Englishtown, Cape Breton County. A deposit of infusorial earth, said to be of excellent quality, has been largely dug by Mr. F. Torrence. The deposit is in a small lake behind the village.

River Denys, Inverness County. A deposit at this place has had a certain amount of work done on it.

Castlereagh, Cumberland County. A large deposit of infusorial earth occurs in Bass River Lake. The lake has been drained for the purpose of working the deposit.

St. Ann's, Victoria County. For several years an important deposit of infusorial earth was worked at a lake near St. Ann's. The deposit is from 3 to 4 feet thick and extends over a large area.

Other places at which Diatomaceous earth has been found are: Lake Ainslie, Inverness County; Lochaber, Antigonish County; MacKay Lake, Garden of Eden Lake, Grant Lake, Ben Lake, Pictou County; MacKintosh Lake, Gully Lake, Colchester County; Grand Lake and Dartmouth Lakes, Halifax County; and Kempt Lake, Kings County. There is no large demand for this mineral at the present time. Its turn, however, may come.

MOLYBDENUM.

Molybdenite is the most common ore of Molybdenum, and the ore of molybdenum most widely occurring in Canada. It is found in foliated masses or scales and resembles graphite, but it differs from graphite in having a bluer color and giving a greenish streak on porcelain. It is a very soft metal and can be scratched by the finger-nail. It usually occurs in a hard gangue, largely quartz and feldspar. Its specific gravity is from 4.7 to 4.8.

Molybdenum is a metal of the Chromium group, resembling iron in its white color, malleability, difficult fusibility, and its capacity for forming steel-like alloys with carbon. Its specific gravity is 9.01, symbol Mo., atomic weight, 96.0. It occurs only in combination, chiefly in Molybdenite, wulfenite and scheelite, and in small amounts in ores of iron and copper.

It is used in the form of ferro-molybdenum to harden steel. Certain compounds of it are used in coloring pottery and fabric and in analytical chemistry.

How's Mineralogy, published in 1868, gives the first information of molybdenite in Nova Scotia. It mentions Gabarus, in Cape Breton County, Hammonds Plains and Musquodoboit in Halifax County, and Chester, in Lunenburg County. It is found in drift in Halifax County, and in situ in the other counties. Since the publishing of How's work the mineral has been found at Chegoggoin Point, about

four miles north from Yarmouth. Jordan Falls, Shelburne County; Gaspereaux River Road, Cape Breton. The deposit here is about four miles south-east of Big Pond, near Glengarry Post Office. This mine is marked as a blacklead mine in Churche's map of Nova Scotia.

It is found also at North River, St. Anne's, Victoria County. In none of these places have attempts been made to mine the mineral for commercial purposes and it is quite probable that at present prices renumerative work could be done at some of these deposits.

It has been recently discovered that an alloy of equal parts of Molybdenum and tungsten makes a substitute for platinum which is selling now (1916) at $88 an ounce, or four times the price of gold. These two metals have long been known and used, but only lately has it become known that they can be made to resist oxidation.

Molybdenum has many of the characteristics of tungsten. The latter melts at 3000 degrees Centigrade. The former melts at 2500 degrees centigrade. They are insoluble in any of the common acids, and their tensile strength exceeds that of steel. Their specific gravity is 70 per cent. greater than lead, and they can be drawn to finer threads than any other metal.

The serious objections to them were that they oxidized easily at a red heat, and they did not readily solder with gold, and its alloys, and that the larger wires were quite brittle. An alloy of tungsten and molybdenum, half and half, has been produced in wrought form that gives good results. Except in two respects, pure ductile tungsten and molybdenum, meet all the conditions of a practical substitute for platinum and its alloys.

The two objections in the alloy, its ease of oxidation and the difficulty with which it can be soldered, have been overcome by coating with a precious metal or alloy, the resulting material being in many ways much superior to platinum or its alloys.

Molybdenum and tungsten are not so expensive as platinum. The latter was quoted in December, 1915, at $3,000 a ton for 60 per cent. ore. It is now even higher. Molybdenum ore was $750 a ton before the war, it was quoted in February, 1916, at $3,600 a ton. These metals, are necessary to the making of high speed tool steel, as they prevent it from losing its temper, even when red hot. They are in great demand by makers of artillery and ammunition.

BARITE.

This mineral is the native sulphate of barium and is found at Cape Rouge, Inverness County; Lake Ainslie; Black Brook, near Springhill; Bass River, near Five Islands post office, Colchester County; River John, Pictou County, and at Middle Stewiacke. The vein at River John is four feet wide. The present workings are at Scottsville and at East Lake-Ainslie, Inverness County. The properties leased here cover an area of, at least 700 acres, and the vein is from six to thirteen feet, dipping south-east 55 degrees. At Scottsville, the mine is on the T. C. Campbell property, and there is a mine on the MacMillan property at East Lake-Ainslie. The refining plant is at Scottsville, and has a capacity of one ton of finished product in an hour. Both mines are in operation at the present time.

At Five Islands, 208 tons were mined in 1874, and shipped to the United States. In 1875 there were 175 tons exported. In 1876 much of the small quantity of barite mined at Five Islands was locally used in the making of paints. It was sold in 1876 in small quantities to the Dolphin Manufacturing Company, by the people of that district, and although the whole consumption of barite by that Company was only 50 tons a year, the production was so small the Company had to import some to meet their requirements.

In 1877, 23 tons only were mined in the Province and used locally. From 1879 there was no production until the year 1886 when Henderson and Potts mined 230 tons at Brookfield. In 1899, 160 tons were mined at Cape Rouge; and 200 tons that had been mined, were shipped from Lake Ainslie in 1898. Henderson and Potts mined 800 tons of high grade ore, and in 1901 the same company mined 600 tons at Cape Rouge. In 1903 Cape Rouge produced 200

tons and Lake Ainslie produced 500 tons. In 1909 there were 2,000 tons mined at Lake Ainslie and in 1910, 162 tons and in 1913, 700 tons. In 1915 there were 1,800 tons refined and shipped and the total output from Lake Ainslie since 1902 is in the vicinity of 20,000 tons. These mines have been operated for a number of years by The Barytes Limited, of Halifax. The texture of the powder of barytes or artificial precipitate, its color and inertness combine to make it serviceable in the preparation of white mixed-paints, lithopone and blanc fixe and as a base for colored pigments, imitation marble, white figures, jasper ware and in enamels for porcelain, pottery and enamel wares.

Barytes is the most permanent pigment filler, being unaffected by sulphurated hydrogen, acids, and weak alkalies. One gallon of the dried powder weighs from 15 to 18 pounds according to fineness. This mineral, sometimes called "heavy spar," is theoretically composed of 65.7 per cent of barium oxide (BaO) and 34.3 per cent. of sulphur trioxide (SO^3) and has the chemical formula Ba So^4. Its specific gravity ranges from 2.5 to 3.5. It can be distinguished from calcite by its greater weight and by the acid test. In the trade, two types of the mineral are recognized, the crystalline and the soft. The hard crystalline variety has a glassy, semitransparent appearance and can not be broken by the hands. The soft barytes can be crumbled by the fingers, and has a dull, milky appearance. The soft variety is preferred by the grinders, and is said to roast better than the hard crystalline variety. The hard type can be used better in lithopone and chemical industries than by the grinders.

The average price of crude barytes in the United States, in 1915, was $3.51 the short ton, and the price has had a slight advance since that date. The total consumption of barytes in that year in the United States was 111,051 tons of 2,000 pounds.

As all barium compounds are poisonous, care must be exercised in their manufacture.

MANGANESE.

The ores of manganese found in Nova Scotia are known for their purity. They occur at a number of places in the Province. The best known locality is from Tenycape to Walton, in Hants County. This rich and pure ore has been wrought at intervals for a number of years, but sufficient attention has not been given to it.

Many tons have been shipped from this district yielding as high as from 88 to 95 per cent. of available peroxide of manganese. One pocket at this place gave 1,000 tons of ore, the price realized being $130 a ton.

The pyrolusite occurs in strings and pockets in limestone at its contact with the underlying Devonian sandstone. Similar ones are found at Onslow and at Manganese Mines, near Truro; and at Enon, near Loch Lomond, Cape Breton. These latter mentioned deposits have not been mined to any extent. More recent discoveries have been made at New Ross, Lunenburg County, and in Cape Breton County. These deposits are of good quality. The ore occurs in beds and in irregular layers and nodules in soft sandy shale and associated with a dark manganiferous limestone. This ore runs as high as 88.9 per cent. of binoxide and very low in iron.

The most common of manganese ores is "wad" or bog-manganese. It is not so valuable as the other ores of this metal. It is found at Jeddore, Ship Harbor, St. Margaret's Bay, Shelburne, La Have, Springhill and Parrsboro.

The Nova Scotia Manganese Co. opened a mine at

New Ross, Lunenburg County in 1910, and raised 25 tons; in 1911 the output increased to 160, and in 1912, 223 tons were produced; but operations ceased and nothing more was done until the Metals Development Co. took over the property and have been working it since early in 1916.

The ore here is a mixture of psilomelane and manganite and is suitable for ferro-manganese. An analysis of what is termed blue ore at this mine gave manganese dioxide 70.5 per cent. The total shipment of manganese, since first mined in the Province, is about 9,000 tons.

At New Ross the vein is vertical and has been traced by float about 1000 feet. Its course lies north 70 degrees east. The vein at the surface is composed chiefly of botryoidal hematite, with some ochre and a little pyrolusite. At the depth of 26 feet the pyrolusite begins to increase; and at 30 feet the vein is 14 inches thick and composed of five inches of good manganese ore and nine inches of mixed iron 100 feet, dips south and at an angle of 65 or 70 degrees.

The following analyses show the general character oxide and crushed pyrolusite and granite. From a depth of 30 feet the ganite on both sides of the vein is of a hardness similar to clay. The average width of the manganese ore is about 10 inches. The vein from a depth of 30 feet to the bottom of the shaft, these ores:—

	At Douglas 15 miles south of Tenycape	Cheverie.
Moisture	1.66	2.05
Water of Composition	3.63	
Iron peroxide	.60	2.25
Oxygen	7.03	
Baryta	.72	1.12
Insoluble	1.72	2.80
Phosphoric		1.02
Manganese oxides	84.62	
Peroxide of Manganese		90.15
Lime		trace

The manganite at Walton and Cheverie bears the following analysis:

	Tenyeape.	Cheverie.
Manganese Oxides	85.54	86.81
Iron Peroxide	1.18	2.05
Baryta	.89	
Phosphoric	.34	
Insoluble matter	1.27	1.14
Water	8.54	10.00
Available oxygen	51.54	17.73

There were 544 tons of manganese mined in the Province in the fiscal year ended September 30th, 1916.

TUNGSTEN

The chief tungsten ores are wolframite, scheelite, and hubnerite. Wolframite is the heaviest of these, its specific gravity being 7. Next to wolframite, scheelite is the chief ore of tungsten. It is white, cream, yellow or brown in color. It can be readily scratched with a knife. Its specific gravity is 6. It resembles calcite, but is more than twice as heavy as this mineral. Hubnerite is closely related to wolframite in the shape of its crystals, specific gravity and hardness. The last named mineral is found at Emerald, near North-East Margaree, Inverness County. Scheelite is found at Moose River, Halifax County. The largest vein is 22 inches, and is exposed in the bed of Stillwater Brook. It has been found in the workings of Moose River mine, two miles to the east, and some of the ore has been found on a dump at the Touquoy gold mine, one and three quarters of a mile eastward from Stillwater Brook. Tungsten ores are reported at New Ross, Lunenburg County, but up to the present it is not found in such quantity as warrants development.

The first shipment of tungsten-bearing mineral from Nova Scotia was 14 tons of scheelite-concentrate, containing 72 per cent. tungstic acid, taken from the scheelite mines, Moose River, in 1912. The capacity of the mill is 30 tons in 12 hours.

The mill was erected in 1911 and produced a high grade concentrate. The mine ceased production in 1913, after a small production of 10 tons. There

were 40 tons of schulite ore mined here in 1916.

Prospecting for tungsten-bearing ores has been engaged in during these last few years, at a number of places in the Province, but nothing of economic value has been reported. This metal was formerly considered of interest as a chemical element only. It is now an article of commerce and industry and a very valuable one. It is one of the very hard and heavy metals, having a specific gravity of 16, nearly as heavy as gold. Its melting point is 3,080 degrees Centrigrade. It is one of the most infusible metals known, and is much used in the making of incandescent lamps, the filaments being much superior to carbon filaments in that it produces a white light, while carbon produces a smoky deposit that injures the light. Tungsten produces no sutty effects in its white incandescent condition. Apart from this, the manufacturers of tungsten lamps claim for them a better light with less power.

Considerable quanties of tungsten are used in the making of tungstates, which are used as a mordant in dyeing to give weight to silks, and in rendering fabrics fireproof; but the chief demand for tungsten is in the making of steel, the adding of a small portion of tungsten increases the elasticity and tensile strength of the steel.

SILVER.

Silver occurs in Argentiferous Galenite (silver-lead ore) in various parts of the Province, more particularly in limestone and pre-Cambrian districts, also associated with gold ores and in small quantities in other ores.

Native silver and its carbonates have also been proved disseminated through the drift of MacKenzie River, Inverness Co.; and sulphate of silver has been reported from Watchabueket, south-west of Baddeck, Victoria Co.

Argentiferous galenite is also found at Smithfield, near Upper Stewiacke. There has been considerable exploratory work done here. The ore is found here in carbonifrous limestone.

Argentiferous galenite likewise occurs near the head of Musquodoboit Harbour, Halifax Co., where it has been prospected to some extent; and near Glenelg, West River, St. Mary's, Guysboro Co., near East River, Pictou; Gay's River, Halifax County and in many other limestone districts.

Argentiferous galenite was discovered in 1895 at L'Abime Brook, Inverness County. The face of the opening shows 20 per cent galena and 3 per cent. copper. The ore is reported to carry on an average one ounce of silver for every unit of lead, with gold in places up to 14 dwt. to the ton.

Silver is a white metal, ductile, very malleable, sonorous and capable of a high degree of polish. It has a high electric conductivity. Its atomic weight

is 107.8; symbol Ag. It is one of the "noble" metals. Not being easily oxidized, it is used for coin, jewellry, plate, and in the making of a variety of articles. It is usually allied with copper to increase its hardness. British coin silver, known as sterling silver, has a fineness of .925; United States silver a fineness of 900. Pure silver has a specific gravity of 10.5 and melts at 1764 Fahrenheit.

Canada produced 32,000,000 ounces of silver in 1910, having increased the production from 6,000,000 ounces in 1905. Within the last 25 years the value of silver has decreased from $1.30 an ounce to 54 cents. More than 90 per cent. of Canada's production is from the Cobalt silver ores of Northern Ontario.

ZINC—COPPER—LEAD.

Gold, in these pages, should, possibly, be given a prior place to any of the other metals, for the reason that, in the history of Nova Scotia, it has played a more important part. Of late there has been a decline of gold mining in the Province, attributed to varying causes. This decline, by many considered competent to express acceptable opinion, is held to be only temporary, and their belief is that the mining of this precious metal may soon again become active. It is, therefore, considered desirable to defer remarks on gold mining till after some other of the metals have been referred to. By doing this it will be possible to relate the latest opinion as to the future of gold in the Province. Further, it may be said, that as there has been no serious exploration of lead ores, it is not a subject of controversy, and, therefore, throughout this chapter, there will be smooth sailing.

The chief ore of lead is galena, and it is found in this Province, principally in the Carboniferous limestones and in the pre-Cambrian formations. There are usually five metals closely related in the geologic occurrence of these ores, and are also classed together in their metallurgical treatment. These ores are gold, silver, copper, zinc and lead. Some ore contains all five of these metals; some contains three, some four of them, and a few ores contain only one of them. Gold and silver often are associated, as is lead and zinc. Lead ores almost always

earry silver; and copper ores usually produce gold and silver. Sometimes all five metals above named are eontained in commercial quantities in the same ore. These are termed mixed ores. Lead ores are those carrying more than 4½ per cent. of lead, and zinc ores are those carrying more than 25 per cent. zine.

Reeently a large deposit of ore earrying all five metals has been diseovered at Stirling in the County of Riehmond. The property has been bonded to a wealthy New York eompany, and boring operations are now earried on to test the thickness of the veins, which are reported to be rieh.

Lead ore is found at Upper Stewiaeke, Colchester County. There has been some prospecting done there. The ore is found in the Carboniferous limestone and contains lead about 57 per cent and silver about 25.5 ounees to the ton. This deposit should be now of eommercial importanee.

At Chetieamp, Inverness County, there is a mine from which a test of ten tons was taken in the summer of 1915.

Lead ore also occurs at Boisdale and East Bay, in Cape Breton County, near Musquodoboit, Halifax County, and at L'Abime Brook, Inverness County. The ore at the last mentioned place was discovered in 1896. It showed an analysis of 20 per eent. galena and 3 per eent. copper, and was reported to carry one ounee of silver for every unit of lead, with gold in plaees up to 14 dwt. a ton.

The lead industry has been mueh affected by the war in Europe. Larger quantities of "pig" lead have been shipped from the United States than have ever been shipped before, bringing that country a gain of 7,662,000 dollars in 1915 over any other year's sales.

There is no lead mined in Nova Scotia at present. but indications look bright for a development of this industry in the near future.

The following in referenee to the deposit at Stirling is from the latest—at the time of writing—sum-

mary Report of the Canadian Geological Survey:—

The first work is believed to have been performed on the Stirling zinc-copper-lead deposits about twelve years ago. This work was of only a prospecting nature, and included the sinking of a shallow shaft or pit, and the digging of a few trenches or open-cuts. The only mineral that was known to occur in these deposits, which was considered to be of economic importance, was copper, and there did not appear to be enough of this to pay for working. Nothing further was done in the way of development until recently. Since the war the demand for various metals has greatly increased and one of those most required is zinc. Accordingly, as the Stirling deposits contain important amounts of this metal, the property was leased from the government of Nova Scotia on August 2, 1916, by James P. Nolan who obtained licenses to search for minerals over five blocks of 5 square miles each. From these licensed tracts he selected and took up two leases each of one-half square mile, which include the right to prospect, mine, etc. One of these leases covers zinc and the other does not, in which latter case the zinc goes with the surface rights of the farmer who owns the land. An option on Nolan's leases was obtained by H. H. Sutherland of F. C. Sutherland and Company of Toronto, who also secured from the owner of the surface rights, an option on the zinc for the area of the lease not covering this metal. In addition, Mr. Sutherland obtained from the Nova Scotia government several permits to search for minerals in this vicinity.

During the past summer (1916) some surface development, mainly in the form of trenching, was done on the deposits, which showed them to be of decided economic importance. The writer was instructed by the Director of the Geological Survey to examine the occurence, and accordingly a couple of days were spent in this district during the early part of December. The deposits were carefully examined and sampled, as far as exposed.

Since visiting this property, the writer is informed that it has been purchased by J. R. Ray and F. C. Sutherland and Company, both of Toronto, who have resold a 65 per cent. interest to Hayden and Stone of New York, and the American Zinc Company, of Boston. The new organization operating the property is named the Stirling Mining and Smelting Company. Diamond drilling was commenced and by the end of Janury (1917) was well under way, a 3,000-foot contract having been let. If the deposits prove satisfactory, extensive operations are contemplated for the immediate future.

The Stirling zinc-copper-lead deposits are located in Richmond county, in the south-western corner of Cape Breton island, N.S., and the development work is all within a few hundred yards of Stirling post-office which is part of the farm house of Mr. John MacLeod. Stirling post office is situated in a direct line between Loch Lomond and Framboise cove, and 7 miles from Loch Lomond, and 5½ miles from Framboise cove, measured in an air line. The leases on which the Stirling deposits occur also adjoin the eastern end of Five Island lake.

To reach Stirling, it is customary to go via the Cape Breton railway which runs from Point Tupper to St. Peters. From St. Peters there are good roads to Stirling, a distance of between 35 and 40 miles. It is also possible to go by boat to Framboise cove or Fourchu bay, and thence drive to Stirling. Going in this way the best road at present runs from Fourchu bay, which is about 9 miles from Stirling, measured along the road.

Ore shipped from Stirling at the present time would have to go to tide water at Fourchu bay, but it is claimed that a shorter, more direct road could be constructed to Framboise cove.

The development work on this property is mainly in the form of trenching. One pit or shaft has been sunk to a depth of 14 feet, and another was sunk some years ago, but when visited had badly caved, and was full of water. Three main trenches have

been dug across the ore deposits, which will here for convenience be designated as A, B, and C. No. A trench is about 20 feet long, 6 feet deep, and 4 or 5 feet wide; No. B trench is about 45 feet long, 2 to 4 feet deep, and 4 feet wide; and No. C trench is 108 feet long, 5 to 7 feet deep, and about 4 feet wide. These all run approximatly at right angles to the general strike of the deposits. Also a small trench extends from A to C, a distance of 260 feet, crosses C, and persists possibly 50 feet farther. This trench is 1 to 2 feet wide, and 3 to 4 feet deep. Another small trench crosses trench B, and extends thence northward along the general strike of the deposit, about 60 feet. These trenches are all down to bedrock. Another trench about parallel to C, has been dug to the south of C, but did not reach bedrock, as the superficial deposits are there quite deep.

In the vicinity of these zinc-copper deposits, the land surface is dominantly flat and wet, and has been intensely glaciated. Glacial and other superficial deposits overlying the bedrock have a thickness in places of as much as 15 feet, but along the three main trenches are only a foot or so deep. The surface is also fairly heavily timbered, mainly with spruce, and numerous small streams traverse the area, but only very imperfectly drain it. Thus owing to the timber, soil, glacial, and other superficial deposits, very little bedrock is exposed in this vicinity, except in the trenches; but wherever the bedrock formation is exposed on either side of the ore deposits, it consists of massive, finely textured, dark greenish to greyish green, igneous rocks having the general appearance of andesites. Since, however, these rocks have not been examined microscopically, the general field name of greenstones is here applied to them. Possibly types related to andesites, including diorites, diabases, or basalts, may occur.

A shear zone having a general trend of apparently about north 65 degrees east (magnetic), traverses the greenstones, and it is within this zone that the ore deposits occur. Every transition may be noted

from quite massive practically unaltered greenstones, to ore composed almost exclusively of zinc blende, chalcopyrite, pyrite and quartz. The greenstones in places merely sheared and altered to a greenstone schist. In other places pyrite has also been introduced in varying amounts. In places also, the rocks in addition to being sheared have been more or less entirely altered to a whitish, finely laminated, talcose substance. In other places, again, the original rock material has entirely given place to quartz, a whitish dolomitic mineral, zinc blende, chalcopyrite, and pyrite. Nearly everywhere, the ores are decidedly laminated, the lamination planes agreeing with the planes of shearing throughout the general shear zone. Even where solid ore now occurs, including mainly zinc blende and chalcopyrite, with some quartz, the lamination planes are still very decided. The deposits are thus evidently due, largely at least, to metasomatic replacement, and have been produced by uprising and circulating solutions, within the zone of shearing, which have more or less entirely replaced the original rock and have deposited along the planes of shearing the minerals now constituting the ore deposits. Sections were measured of the exposures in the bottoms of the three main trenches.

All the ore material exposed in the bottoms of the three main crosscut trenches was sampled, ten samples being taken, which are numbered consecutively from 20 to 29 inclusive. Nos. 20 and 21 were taken from trench A; Nos. 22, 23, and 24 from trench B; and Nos. 25 to 29 inclusive from trench C. In trench A, 10 feet of ore is exposed, and in trench B, there is over 33 feet of ore material. The actual distance between the ends of these trenches is over 100 feet, and the offset distance, measured at right angles to the supposed general direction of strike of the deposits, is about 90 feet, throughout which width it is not known whether ore occurs or not. Trench C is about 260 feet from A, measured along the general strike of the deposits, and ore material

is exposed throughout this distance in the bottom of a narrow trench extending from A to C. In trench C there is 66 feet of ore material, and about 135 feet still farther to the south-east, measured as an offset at right angles to the general strike of the deposits, a shaft has been sunk 14 feet in the bottom of which good ore was found. No work has yet been done to determine the amount of ore in this intervening 135 feet. Altogether these deposits have been actually traced by trenching along the general direction of strike, for a distance of over 300 feet, and they have an aggregate exposed width in trench C of over 66 feet. The amount of ore material here would thus seem to be decidedly important.

"When visited, the Stirling deposits had been very slightly exposed, nowhere to a depth exceeding 7 feet. Thus no estimate of the ore in sight could be made that would do justice to the property. From what was seen, however, all the evidence indicated that the deposits are probably quite extensive, and persistent both longitudinally and vertically. The grade of much of the ore material is also high. In one trench, for a width of 10 feet, the ore carries from 11 to 30 per cent. zinc, as well as significant amounts of lead, copper, gold and silver. Also, in the main trench, there is 20 feet of ore containing 17 per cent. to over 27 per cent. zinc, as well as important amount of lead and copper, and some gold and silver. In this trench, also, there is over 40 feet of ore material, which though of lower grade is still of consequence.

"In the past, similar complicated zinc ores have presented many difficulties in the way of treatment, but a great amount of research and investigation has recently been done along these lines, and no doubt the owners of the Stirling deposits will be able to evolve a satisfactory method. In this event the deposits will become an important source of zinc-copper-lead ores in the near future. The finding and development of these deposits should also greatly stimulate prospecting in Cape Breton, and it is

hoped that, as a result, other important ore-bodies will be found."

No.	Percentages					Ounces, Troy, per ton 2,000 lbs.	
	Copper	Lead	Zinc	Antimony	Nickel	Gold	Silver
20	2.09	4.21	29.44	None	None	0.08	1.96
21	1.36	1.76	11.71	,,	,,	0.06	trace
22	0.52	1.40	3.71	,,	,,	0.06	,,
23	0.23	0.11	3.88	,,	,,	0.04	0.25
24	0.67	2.34	7.90	,,	,,	0.04	trace
25	0.25	1.04	3.71	,,	,,	0.04	,,
26	3.43	7.52	27.05	,,	,,	0.06	7.38
27	2.20	4.78	17.66	,,	,,	0.08	1.26
28	0.32	4.78	5.71	,,	,,	0.04	0.20
29	0.82	0.26	6.84	,,	,,	0.03	trace

ASBESTOS.

A fibrous mineral named by the finders Asbestos, has at intervals been reported as having been found at certain points in the province, but as to the quality, exact information is unavailable, as the work done on any find was more experimental than practical. The "finds" so far have not given indications of being in quantity to warrant operations; and besides, as the demand was not urgent there was no incentive to continue prospecting or exploitation. The Asbestos field, it may be said, is still virgin. As no doubt after the war there may be more prospecting for mines in the province than at any previous time, the following description from the Geological Survey Department may be of service. The description refers to the Asbestos presently being extensively worked in Quebec:—

"It occurs in reticulating veins up to 4 or 5 inches in width, in serpentine rock, the fibres, which are easily separable, are very fine, of a silky appearance, and flexible to a high degree. Asbestos is unaffected by heat, except on continued exposure to high temperatures, and is noncombustible. It is a poor conductor of both heat and electricity, and is not attacked by the common acids.

The above characteristics make this mineral an important raw material in a number of manufacturing industries.

Asbestos fibre may be spun into yarn and rope, and woven into fabric, in which forms it finds many

uses where a fire resisting fabric is required. For these purposes a long fibre, both strong and very flexible, is desired. At present there are no factories in Canada weaving asbestos.

In this country the principal manufactures of asbestos are mill board, paper and shingles, for which purpose a short fibre is used.

In the making of certain mineral flooring short fibre asbestos enters into the mixture, where it acts as a binder.

On account of its low electrical conductivity, it is used as an insulator in electric instruments. While asbestos paper and mill board are principally used for this purpose, considerable long and short fibre are also employed. Short fibre is mixed with paints to produce a fire resisting paint. It is also used in making stove cement, pipe covering, etc.

Long fibre, besides the uses referred to above, is used in making gaskets for packing glands and pipe joints where high temperature or acid solutions are encountered, making of chemical water and filters, and as a surfacing of gas grates."

The many uses to which Asbestos can be put are becoming better known, as time passes. Asbestos in England, for roofing purposes, has not been very extensively used in the past, but there are many indications that its remarkable wearing qualities are becoming more and more widely recognized, and that there will be a rapidly increasing demand for it as time goes on. It has been found especially adaptible for use in the large industrial districts, such as Lancashire, where, owing to the corrosive atmosphere fumes the life of galvanized iron sheeting is not more than from three to five years, whereas asbestos is not at all adversely affected by such conditions. It is becoming a common practice now, when galvanized iron sheeting needs repairing or replacing, to substitute asbestos-cement sheets. This piece-meal substitution is facilitated by the use of sheets made to the same dimensions

as the standard corrugated iron sheeting.

This mineral was possibly better known to the ancients than it is today and of course it was more highly appreciated. Linen in old times was made from it. It is within the memory of man that the very crudest kind of apparatus for giving light were in use in Britain years ago. The ancients had what were called "perpetual" lamps, the wick employed being asbestos. It is principally used in this province for covering steam pipes and in some cases for backs of stoves. The Asbestos so far found in Victoria and Cape Breton counties has not proven of value sufficient to warrant development, but as in the case of some other of the minerals no systematic or persistent exploitation has been done.

ANTIMONY.

Stibnite or sulphide of antimony occurs at West Gore, Hants County. It is mined in a shaft 700 feet deep. It was discovered in 1880, and the size and value of the ore bodies are well maintained. The deposit carries gold and silver. The ore occurs in two fissure-veins, and has been traced 1200 feet. The veins vary from two inches to seven feet in thickness. The ore-shoots dip 4 degrees southeast, and gold is most plentiful where the percentage of stibnite is high.

Except where a cross-vein of quartz comes into the vein at No. 1 shaft, none of the gold is free, even in ore assaying as high as 10 ounces of gold to the ton. Assays of second-class ore have shown as high as 186 dollars a ton of 2,000 pounds. A very conservative estimate of second-class ore left in the vein, gives it an average thickness of 6 inches, containing twelve per cent. antimony and twenty three dollars gold to the ton of 2240 pounds. There are four shafts on the north vein.

Previously to 1910, there were 3357 tons shipped. For a long time it was not known that the ore carried gold.

This mine produced 191 tons of concentrate in 1911, this being the first production since 1907. There was no output from 1911 to 1915. The mine was unwatered in the autumn of 1914 and was producing in 1915; 10,872 tons being produced during the fiscal year ended September 30th. The produc-

tion for 1916 was 14,149 tons of ore.

In 1905, 4,000 tons of ore were produced: 427 1-4 tons of mixed ore were shipped to English smelting companies, and contained by assay, gold 1,232 oz., 16 dwt. 23 gr., valued at $24,657. In 1906 there were shipped 782 tons 1,186 lbs. or ore, which yielded 1,031 oz· 11 gr. of gold. In 1907 the production was 3,042 tons of ore, and 1,403 tons were shipped, most of the shipment being 20 per cent. ore. The average amount paid for this ore was $48.39 per ton. In addition to this the ore contained 1319 oz. of gold, only part of which the smelting companies made payment for. Shipments were made to the following companies:—Hoyt Metal Co., Meallgesell-Schaft, Merton & Co., and the American Metal Co. By assay the ore gave from .77 to 2.06 oz. gold to the ton.

In 1908 the company operating the mine got into difficulties and work ceased early in the Spring of that year. The mine is now operated by the West Gore Antimony Co. The demand is good.

A sulphide of Antimony occurs near Rawdon, Hants County, which carries gold and silver. A mine was opened here, and about 3,000 tons were shipped. Other deposits are known in this locality which carry high gold values·

Stibnite is an ore of a light colour; has a brilliant lustre. It belongs to the non-metallic class. Its specific gravity 5.524.62, symbol S 52 S 3. It is the chief ore of antimony. It is used in safety matches and fireworks, in the manufacture of rubber goods and in refining gold. Since ancient times it has been used in Eastern countries as a cosmetic.

The follow assay shows the value of this ore.

	From Pay Streak	From low grade ore
Antimony	45.75 per cent.	18.21 per cent.
Gold	2.48 oz. per ton	.23 oz. per ton
Silver	·10 oz. per ton	.13 oz. per ton

GRAPHITE.

It is probable that the occurences of Graphite in different localities was discovered more by accident than by search. Prospectors in going round the country in search for some other mineral have run against a deposit here and there, but beyond making the fact of the discovery known, no exploration, in the majority of cases, followed, chiefly for the reason that there was no market near at hand. The time may come when there may be a demand and then, no doubt, the mineral will attract attention. The following in reference to the mineral is from a report of the Geological Survey, and gives all information procurable up till the present:—

"While the occurence of graphite in certain rock-formations in Nova Scotia has been known for many years, up to the present time but little has been done in the way of economic production. Several attempts have, however, been made, more especially in the eastern portion of the province, to exploit deposits of this material, but so far these do not appear to have been attended with much success.

The principal occurrences of graphite in the provinces are described as belonging to the island of Cape Breton. Here the mineral is found chiefly in rocks which have been assigned to the pre-Cambrian age, consisting of crystalline limestones with slates and shales which are associated with granite intrusions. In places, as at Glendale, River Inhabitants, Inverness county, it is found in a coarse red

syenite full of graphite specks. At Dallas Brook the rocks are felsites, limestones and slates with which the syenites are associated, and the limestones are graphitic, while beds of graphitic shale also occur. These black shaly beds were at one time mistaken for coal strata. The graphitic limestone is sometimes burned for lime; the horizon of these rocks is that known as the George River limestones, a portion of the Archaean.

One of the graphitic shale localities is found half a mile south of Guthro Lake near the French Vale road. The band at this place is said to have a breadth of two to three feet and can be traced for some distance on the strike. An Analysis of this shale was made in the laboratory of the Geological Survey and gave graphite 38.387 per cent. Report of Progress Geol. Surv. Can. 1879-80 p. 1-2. The purified graphite from this place, when completely separated is of fair quality, and appears to be well adapted for lead pencils, electrotyping, and for most of the numerous uses for which graphite is available. Its value as an economic product would appear therefore, to depend largely upon the cost of its extraction and preparation for the market, necessary to ensure the requisite amount of purity.

The percentage of graphite in the Glendale shales appears to vary considerably in different parts. Thus, samples, collected in 1878 by Mr. Hugh Fletcher and assayed in the Geological Survey laboratory, gave of graphite only 13.965 per cent, but a more recent assay by Dr. Hoffmann, of material from the same deposit, made for Mr. James McIntosh, yielded graphite 31.8 per cent. A later assay is given in the report of the Mines Department for Nova Scotia, of the shales from Christmas Island which is practically the same deposit, in which the percentage of graphite is given as 50.23, with rock matter 43.37 and water 6.50. These shales apparently belong to the Cambrian rocks of Cape Breton.

On Cameron and Dundas Brooks the gneiss, hornblends schists and dark slates of pre-Cambrian age are blackened with the contained graphite, but no definite information as to the actual graphite contents are available.

In the county of Guysborough, near the Tor Bay road, several pits have been opened along the Salmon River in a black slate which is probably of Devonian age, and near the contact of the gold-bearing slates. These slates apparently contain a fair percentage of graphite.

The occurrence of graphite has also been reported from West Bay, Grand Narrows, East Bay, and Hunters Island, and in addition, Mr. Gilpin, in his Report of the Mines of Nova Scotia 1880, mentions its presence, mostly in the form of plumbaginous shales, at Parrsborough, Salmon River, Musquodoboit, Hammonds Plains, Fifteen-mile Stream, Boularderie Island, Gregwa Brook ,and Gillis Brook, the last three being in Cape Breton. Concerning the extent of these deposits, no particulars are available, and but little attempt at mining has been done for some years; so that the actual economic value has apparently never been ascertained. The above mentioned localities appear to include the principal deposits as yet known to exist in this province."

MAGNESITE.

This mineral has not heretofore been given a place in any publication descriptive of the economic minerals of Nova Scotia. Some attention was given to it in 1917, for the first time in Nova Scotia in all probability, due to its discovery, and production to a limited extent by the Nova Scotia Steel and Coal Co., who found the mineral suitable for certain purposes of the company. The discovery was made at River Denys, Cape Breton. The deposit was not an extensive one and soon became exhausted. Its discovery and usefulness has inspired the hope that the mineral may be met with in other districts, and this hope is strengthened by the thought that if a mineral not sought after has been encountered, a systematic search may result in revealing many other hiding places. Indeed its discovery has led old prospectors to imagine, if not really believe, that just such a mineral, or one closely resembling, had been met with in the course of prospecting in several localities but that no attention had been paid it, as it was considered a white clay, or some sort of soft native cement. Near Whycocomagh, several years ago, a mineral, now admitted to closely resemble magnesite, was uncovered in a search for iron ore, but as, at that time, the name was unfamiliar and its uses and properties not known to the prospectors, it attracted no more than a passing notice. The question may have been asked, "What is it" and as there was none to answer, nothing more

was said or done in reference to it. Its value now being known the probability is that the numerous by times prospectors will include magnesite as a mineral worth looking for. Or it may be that the Steel companies may employ skilled prospectors to search for the mineral.

The following description of Magnesite, its nature and uses, is by Fletcher Hamilton, and was contributed by him to a publication named "Foot Notes" whose main purpose is to give description of the rarer and less known minerals:—

"Magnesite is a natural carbonate of Magnesium, and when pure contains 52.4 per cent· C. O. (Carbon dioxide), and 47.6 per cent. Mg. O (magnesia). It has a hardness of 3.5 to 4.5 and specific gravity of 3 to 3.12. It is both harder and heavier than calcite (calcium carbonate) and also contains a higher percentage of C. O. 2, as Calcite has but 44 per cent.

Most of the California Magnesite is comparatively pure, and is ordinarily a beautiful, white, fine-grained rock with a conchoidal fracture resembling a break in porcelain. The Grecian Magnesite is largely of this character, while the Austrian varieties usually contain iron so that they become brown after calcining. The Washington Magnesite, one of the most recent developments, resembles dolomite and some crystalline limestones in physical appearance. Its color varies through light to dark gray and pink.

In California, the known magnesite deposits, with a single exception (a sedimentary deposit in Kern County) are associated with Serpentine areas. The Washington deposits are stated to be associated with extensive strata of dolomite limestones."

"**Uses**—The principal uses at the present time include the following:—

"In refractory linings for basic open-hearth steel furnaces, copper reverberatories and converters, bullion and other metallurgical furnaces; in the

manufacture of paper from wood pulp; and in making flooring, wainscoting, tiling, sanitary kitchen and hospital finishing, etc. In connection with building work it has proved particularly efficient as a flooring for steel railroad coaches, on account of having greater elasticity and resilience than Portland cement. For refractory purposes the magnesite is "dead-burned"—i.e.—all or practically all of the C. O. 2 is expelled from it. For cement purposes it is left "caustic" i.e. from 5 per cent. to 10 per cent. of C. O. 2 is retained. When dry caustic magnesite is mixed with a solution of magnesium chloride (Mg. Cl 2) in proper proportions, a very strong cement is produced, known as oxychloride or sorel cement. It is applied in a plastic form, which sets in a few hours as a tough, seamless surface. It has also a very strong bonding power, and will hold firmly to wood, metal or concrete as a base.

It may be finished in a very smooth, even surface, which will take a good wax or oil polish. As ordinarily mixed there is added a certain proportion of wood flour, cork, asbestos, or other filler, thereby adding to the elastic properties of the finished product. Its surface is described as "warm" and quiet, as a result of the elastic and non-conducting character of the composite material. The cement is usually coloured by the addition of some mineral pigment to the materials before mixing as cement.

The desirable qualities of flooring material (cost not considered) are listed for purposes of analysis or comparison under eighteen heads as follows:—Cleanliness (sanitary qualities), quietness, immunity from slipperiness, appearance, waterproof character, plasticity, warmth (thermal insulation) life (immunity from deterioration by age) acid-proof character, alkali-proof character, fire resistance, elasticity, crushing strength, structural strength (rupture) immunity from expansion and contraction and lightness. The importance of these several qualities varies with the varying require-

ments to be met. For instance, in some places, as in hospitals, cleanliness is one of prime consideration; in other places immunity from abrasion might be one of the principal requisites. As to most of these qualities the conclusion is reached that magnesia cement affords one of the most satisfactory flooring materials for use in kitchens, laundries, toilets and bath rooms, corridors, large rooms or halls in public or other buildings, including hospitals, factories, shops and restaurants."

There is no doubt that the material is steadily coming into more general recognition and favor for these uses. For a few special uses it is more or less disqualified; as an instance, it is not suited for construction of swimming tanks or for conditions of permanent wetness, since under constant immersion it gradually softens, although it is said to stand intermittent wetting and drying, and is recommended for shower baths. Naturally it is not acid-proof, and not wholly alkali-proof, which might be a disadvantage in its use for laboratory floors and tables; but these are rather special requirements. Its cost per square foot is given as 25 to 33 cents, depending on area which is estimated to be lower than marble, cork, rubber, clay, or mosaic-tile, slate or terrazzo, although more expensive than wood asphalt, linoleum, or Portland Cement.

When unsuccessfully used, the causes of failure are ascribable to uncertain climatic changes, lack of uniformity in mixtures used, lack of care on the part of those handling the materials, possible deterioration of materials used through exposure (either before or after mixing) lack of proper preparation of foundations on which the material is to be laid, and, as a very important factor, experience or non-experience in the manipulation, or actual laying and troweling of the material. Data concerning the percentage of magnesium chloride and of ground calcined magnesia, and data concerning the character and quality of filler and colour added

to the commercial preparations, are naturally guarded as trade secrets by the firms already in the business. The examination and standardization of the raw materials used, and of acceptable filler materials, and the establishment of standard proportions for the mixtures would seem to be about the only satisfactory way of attacking the problem.

The condition of the calcination of magnesite for cement uses is important, as the same material may undoubtedly be very greatly varied in its reacting properties by differing treatment in the kiln. It is generally agreed that the magnesite for cement use must be comparatively free from lime, as lime has a greater tendency to re-absorb water and carbon dioxide than magnesia, thereby causing swelling, so that it is not so permanent in the completed cement as a pure magnesia material. The fillers used may constitute 10 per cent to 40 per cent. of the whole cement, and commonly consist of ground marble, sand, sawdust, cork, asbestos, or other materials.

The magnesite used is the finely ground calcined variety (not dead-burned) of certain specified quality, or place of derivation, regularly sold for plastic purposes. This material commonly comes in paper-lined casks, barrels, or boxes, in which form it is fairly permanent, but it deteriorates by exposure, absorbing carbonic acid and moisture from the air. If carefully handled it can probably be kept unopened a year or more, but it should be used within a few weeks after being opened, even under most favorable conditions.

It is stated that some metallic magnesium is at present being prepared electrolytically at Niagara Falls, from magnesite. Ordinarily it is obtained from magnesium chloride.

For refractory purposes the calcined magnesite is largely made up into bricks, similar to fire-bricks for furnace linings. For such, an iron content desirable, as it allows of a slight sintering in forming

the brick. Dead-burned, pure magnesia can not be sintered except at very high temperatures, and it has little or no plasticity, so that it is hard to handle. Its plasticity is said to be improved by using with it some partly calcined or caustic magnesite. Heavy pressure will bind the material sufficiently to allow it to be sintered.

A coating of crushed magnesite is laid on hearths used for heating steel stock for rolling to prevent the scale formed from attacking the fire-brick of the hearth.

Imports—Reports of the United States Bureau of Foreign and Domestic Commerce show imports of calcined magnesite to have been 172,591 tons in 1913, 144,747 tons in 1914, and 63,347 tons in 1915, most of this coming from Austria-Hungary. For the same years the production of crude magnesite (about two tons of crude yield one ton of calcined) in California (the sole producer of those years in the United States) was:—9,632 tons, 1913; 11,438 tons 1914; 30,721 tons, 1915. For 1916, the California output leaped to 154,052 tons of crude, and shipments were begun from Washington."

FIRE CLAYS.

This subject, as in the case of iron ore, is more or less perplexing. There is no denying the fact that there are shales and what are called "fire clays" scattered all over the province. The question then arises:—Why have the deposits not been exploited, except to a very limited and unsatisfactory extent? Is it that the quality of the clay, so far experimented with, failed to give the sought-for results? That is possible, and yet it may be safely declared that the shales and fire clays have not been sufficiently tested. In but rare, if any instances, in any country, has shale or clay been worked which will make fire brick of the necessary heat resisting properties, or, in other words, that is refractory enough to make an acceptable fire brick without the admixture of some other material. Fire clays vary considerably in their chemical composition, but as a rule no clay is considered a "fire clay" which fuses at a point below 1600 degress C. The best fire clays are held to be those high in Alumina and Silica, and low in oxide of iron, magnesia, lime, potash and other ingredients. The suitability of fire clays for certain purposes depends, it is declared, as much upon their physical character as upon their chemical composition.

Possibly a reason why, as yet, no great success has attended the effort to make a suitable fire brick is that experiments have been made only with

fire clays found in the coal measures. The fire clays in this class, as might be expected, often contain nodules of siderite in addition to the carbonate of iron disseminated in fine particles throughout the mass. There are few fire clays that meet all the requirements, as already stated, and it is therefore customary to mix a certain proportion of ground fire brick, ganister, sand or other clay before making up. The proportions of these depend on the nature of the fire clay and the purpose for which the finished article is required. As has been found in the clays and shales of the coal measures, there is a larger or smaller amount of organic matter, and where this is in excess the clay is rendered useless for the making of fire brick.

It wil scarcely be right to say that the proper kind of clay for making fire brick of desired quality has not, as yet, been discovered in Nova Scotia, for that might imply that a persistent and systematic search had been made. It will be more correct to say that the proper kind of clay has not been stumbled upon.

So far as the writer knows no attempts have been made to find clay that might be suitable for fire brick outside of the counties producing coal, whereas clay and shales of varying characters may be found in almost every county.

Fire brick which will stand a fairly strong heat has been made for years by the Intercolonial Coal Company from a seam on their areas. This can be utilized in the lining of ladles, etc., for which it has been found suitable. But the mining of the clay, and the making of bricks was not looked upon as other than an adjunct to the mining of coal, and therefore did not receive first attention. In the late eighties, or say thirty to forty years ago, fire bricks were made in Pictou County from a seam of clay overlying the seam of coal called the "McGregor". Some ten thousand or more were made with varying success. The more successful burns

were those where the largest amount of crushed brick had been mixed, or added to the clay. The experiment could not be classed as serious, as the chief reason for the making of the bricks was to lessen the cost of repairing the coke ovens, by using home made instead of imported brick. The demand for coke gradually fell off and experiments were not long continued.

The question may reasonably be asked: If there are proper shales and fireclays in Nova Scotia why have no serious and systematic attempts been made to utilize them? A reason has already been hinted at, namely—that the idea has largely prevailed that the needed clay can only be found in counties possessing the coal measures, and that nearly all the coal lands are held under lease; and further that the coal operators are indifferent to add side lines to their main business—that of coal mining, which demands fullest care and attention.. Still, further, the market up to the present time, even with the great advances in recent years, in iron and steel production, is too limited to stimulate the search for, and production of suitable clays, which must of necessity precede the erection of the necessary plant for brick making and burning. It has been demonstrated that under circumstances more favourable than at present, or, in short, prior to the discovery of oil wells in the United States, our oil shales are richer than those being mined in Scotland, where several large oil shale works are in operation, making satisfactory returns, and it may be demonstrated as soon as the need for home made fire brick is imperative that the province possesses the necessary shales and clays.

Some years ago the Mining Society of Nova Scotia took up the subject of "fire clays" with the local Government, which promised to render every assistance. As a start the Government offered to have analyses of ten pound samples of clay made free of charge. Intimation of this was given short

publicity. In response one or two samples only were received, and these from parties who had no other end in view than knowing if the clay was valuable in case parties might come along looking for such. Besides free analyses, free practical tests were to be made at the works of the Intercolonial Coal Company at Westville. We in Nova Scotia are free in demanding that the Government assist in the development of minerals and if this be assented to on the condition that the requisitionists do some preliminary work, such as dig a sample of clay, we look sour and think they should do the digging also.

Referring to fire clays encountered in the Inverness Coal Field, a Geological Report, among other things, says:—

"Little attention has been given to the shales of this area, the coal alone having been regarded as worthy of consideration."

Along the South Shore of Inverness, there are a number of good exposures in the cliffs. About an eighth of a mile south of McIsaac Pond, a 2 1-2 foot coal seam outcrops, and this is underlain by a bed of smooth, plastic, moulded clay shale, not less than eight feet thick. The following tests give its properties:—

This smooth plastic shale when ground up ready for moulding had 63 per cent. of grains that would pass a 200 mesh sieve. It was worked up with 21.2 per cent. of water, had an air shrinkage of 5.7 per cent and an average tensile strength of 145 pounds per square inch.

The burning tests of the wet-moulded bricklets are given below:—

Cone	Fire Shrinkage	Absorption	Color
.010	0.8	12.13	Buff
.05	2.6	9.61	Red
.03	6.6	3.18	Red-brown
1	6.6	1.80	Red-brown
3	5	.00	Brown

The bricklets burned at cone 010 had a good ring, and were steel hard at cone 05. At cone 1 numerous blisters began to appear. It is badly blistered and past vitrification at cone 3.

North of McIsaac Pond are a number of low cliffs along the shore showing southerly dipping beds of shales and sandstone.

More sandy shale outcrops a little farther along the shore to the north. Tests show that the shale, although sandy, works up to a very plastic mass with 19.4 per cent. water, and 4.4 per cent. air shrinkage. At cone 010 the fire shrinkage is 0 per cent., absorption 16.01 per cent., and color reddish buff. At cone 03 the fire shrinkage is 3 per cent., absorption 8.88 per cent., and color red. It gives a good hard bricklet at the latter cone.

The most important deposit in the district is the clay overlying the 13 foot or Hussey seam.

This is well seen in the outcrop along Big River, north of Inverness, where a drift was run in, known as the Hussey drift. The coal seam at this point is overlain by a clean looking plastic grey clay, which ranges in thickness from 18 inches to nearly 3 feet. This is in turn overlain by an 18 inch seam of coal, and over this again there is a dark shale, which could not be properly sampled owing to the wash from the upper part of the bank.

The clay is very plastic in its character, and appears to be free from coarse sand, but occasional pyrite nodules were noticed. If this clay seam is worked it would have to be in connection with the 13 foot coal, and as the latter contains good coal in its upper bench, this is not an impracticable proposition.

The following tests give the properties of the clay from the Hussey drift:

It is a very smooth, sticky clay, which, however, contains so much fine sand that only 58.4 per cent passes through a 200 mesh sieve. It took considerable water (30.8 per cent.) to work it up and

had an air shrinkage of 8.5 per cent. The average tensile strength was 206 pounds per square inch. The burning tests on the wet-moulded bricks are as follows:—

Cone	Fire Shrinkage Per Cent.	Absorption Per Cent.	Colour
010	0.3	15.74	Pink Buff
05	4.3	9.79	Buff
03	..	2.25	Dark Buff
1	6.6	....	Buff
3	7.3	0	Drab
5	10	0	Drab
9	5	0	Grey

The clay behaves like a stoneware clay, and its fusing point lies about cone 25.. It makes a good dry-press body at cone 1.

A chemical analysis of this clay made by M. F. Connor, of the laboratory of the Mines Branch, gave:—

Silica	55.52
Alumina	26.80
Ferric oxide	2.58
Titanic oxide	1.50
Magnesia	1.05
Lime	0.25
Soda	0·73
Potash	3.43
Water	8.39
	100.25

This is one of the best clays found in Nova Scotia, and several possible uses suggest themselves. It could no doubt be used for pressed brick. If mixed with some burned clay it could also be used for fire brick. The high plasticity and dense burning qualities also make it available for stoneware manufacture. Lastly, it represents a type of clay used for mixing with short fibre asbestos for making asbestic."

For several years there has been in operation

in Pictou County a company by the name of the Standard Clay Products Company engaged in the manufacture of drain pipe and tile. The business has, apparently, been very successful. In 1916 the company made 1,355,000 feet of drain pipe and tile. The output in 1917 fell off to a trifle less than a million feet, due to conditions brought about by the war. Additions are continually being made to the plant affording proof that the "fire" clay is suitable for the purposes of the company. The clay seam is on the east side of the East River and on the right hand of the eastern highway leading from Stellarton to New Glasgow. In the vicinity of the plant there are other seams of clay or a continuation of the seam now being worked. As with shale, so with fire clay. In some of the localities in which these are found they have been reserved to the Government, while in other instances they belong to the owners of the soil—a most awkward circumstance. The Government should adopt an heroic course and make arrangements whereby all minerals become invested in the crown. The expediency or necessity for such a step is apparent, when it is stated that between Stellarton and New Glasgow, the minerals, with the exception of coal and gold, belong, in nearly the whole territory named, to the soil. There is a solitary area in which all the minerals, including fire clay, are reserved to the crown, or the local government. Further reference may be made to this anomaly in the article on oil shales.

Some forty years ago, a couple of miners, from one of the Pottery districts in Staffordshire, who located at Springhill, stumbled upon a seam of clay on the outskirts of the town, which they considered resembled closely the clay used in the famous English Pottery district, and suitable for crockeryware. To put this belief to practical test they built a small primitive plant for experimental purposes. The result was the production of various pieces of crockeryware ,which considering the primitive appliances

at their disposal, including the crudeness of the machinery, were deemed to be of very fair quality. After a time, owing to limited market, and more possibly to lack of capital necessary to extend the plant, before attempts could be made to cater to outside and larger markets, the work was discontinued.

The writer is of opinion that the exploiters had no serious intention of going into the pottery business, but rather entered into the production of certain wares as byeplay or pastime. However that may be, the work done demonstrated that there are clays in Cumberland county that can be utilized in the production of, if not the finer, then, of the commoner and more generally used kinds of crockeryware.

By and by when there is the expected large increase to the population of the province and thereby a near market provided, and when railway facilities are further enlarged, there can be little doubt that more attention will be paid, to the numerous varieties of shales and clays which the province possesses.

COPPER.

Copper is one of the best conductors of heat and electricity. Symbal Cu. Atomic weight 63.57, Specific Gravity 8.79—8.93; Weight of a cubic foot 557 pounds. It is the only metal that occurs in its native state in large masses. It occurs in various ores; the most important are Chalcopyrite, Chalcocite, Cuprite and Malachite. Pure copper melts at .949 Fahrenheit.

About three-fourths of the world's output of Copper is derived from Chalcopyrite. It occurs in veins, in masses, and is diffused through gaugue material of various kinds, often quartz. .Other sulphides are usually found associated with it; sometimes silver and gold occur; mostly nickel and cobalt. Chalcopyrite is a sulphide of copper and iron—sulphur 35.0, copper 34.5, iron 30.5. Anlysis often show variations from this formulae. When it becomes tarnished it is known as peacock ore. It has a metallic lustre, an uneven fracture, brass-yellow colour and green-black when powdered. It is distinguished from pyrites by its colour and hardness. Copper ores are those carrying more than 2 1-2 per cent. copper. Ores of copper are found at Cape d'Or, Cumberland County, and many outcrops are seen between Springhill and Pictou; some of which have been tested. They are found at Polson's Lake and Lochaber, Antigonish County; at Coxheath, near Sydney; at Cheticamp, Inverness Coun-

ty and in Victoria County, near Oregon. Native Copper was found in the Colonial Copper Company's mine at Cape d'Or, but never in quantities to be commercially valuable.

There are no Copper Mines in operation at present in Nova Scotia. Some prospecting was done in 1917 at Caribou, Pictou County and at Oregon, Victoria County. The total production of Copper in the province has been small. There are only three or four places where Copper has been found in sufficient quantities to warrant investigation. There being at present no assured ore supply, the establishment of a smelting industry is hardly a practical question.

Chalcocite treated at the Crown Mining Co's smelter, some years ago, produced, it was declared, 60 per cent. Copper matte. Chalcopyrite carrying gold and silver, is found in the L'Abime district, Cheticamp, Inverness County. The claim, which is said to be extensive, attracted much attention about 20 years ago. Samples taken across the entire face of the deposit have run from 2.4 to 5 per cent. metallic copper, while samples from lenses have run from 5 to 8 per cent· copper. The ore carried as high as $8.50 a ton in gold and silver. The lowest estimate of the copper contents of the rock, has been placed at 2.5 per cent.

The tabulated statement made below was made some 20 years ago when copper was selling at 12 1-2 cents. a pound. With Copper now selling at 45 cents a pound, the results should show proportionately larger.

Sample	Gold	Silver	Copper
From weathered outcrop ...	$1.32	1.03	2.40 p.c.
From quartz gash veins....	6.60	4.40	7.81 p.c.

One test gave the following values:—

Gold .....13 dwt. to the ton
Silver .....7·83 oz. to the ton
Copper .....7.81 per cent.

With copper at its present price, a ton of the

above should give a value of about $80; of course about 25 or 30 per cent. of this value should be deducted for smelting and marketing.

From 1880 to 1892 Copper was mined at Coxheath.

Mr. Harry Piers of the Provincial Museum who in an official capacity visited the much talked of property a few years ago says of the deposits at Coxheath, the property of the Boston Holdings Co.: "This well known deposit has been extensively developed and is one of the most promising ones in the province.. The Company was formerly known as the Eastern Development Company and until a couple of years ago (1901-2) as the Cape Breton Copper Co. The mining areas cover two square miles and the land and water areas, held in fee, 1094 acres. Four shafts are on the property and the areas have been also well prospected by test pits, and trenches. The first shaft was sunk in 1880 and the last one in 1892. The plant is an excellent one and includes steam hoists, Rand slingers, drills, large ore tables, trams, saw mills, etc. A large amount of ore is on the surface, and a sample taken right across the pile, gave an average of 7 per cent. of copper. The mine has been closed since 1892."

Again the question is asked, "If the ore yields the results given, why is the property idle?" In 1917 reports were current that stimulated by the high price of copper the mine was to be reopened and work proceeded with. But so far nothing has been heard of work having been begun again. At the present time the Coxheath deposit labours under a disadvantage. It is at a distance from transportation. The product of the mine would meantime have to be carried by teams to connect with the Canadian Government Railway at one of two routes, or else a short branch railway would require to be built.

The Colonial Copper Co., began operations in 1900 on a somewhat pretentious scale. The work the Company accomplished up to 1903 may be sum-

marized as follows:—

The property is situated at Cape d'Or, Cumberland County, and comprised three blocks of five square miles, under license to search, and a lease of one square mile. Three mines were opened. Of these, only one, the largest, was accessible at the time of the visit of the official of the Mines Department. It was considered the most important of the three. The deposit at that time being worked consisted of a belt of breciated trap, containing in places boulders and measuring from 35 to 60 feet wide. This belt contains in places masses of native copper. Pieces were seen as large as 100 square inches or more and ranging in thickness from a quarter of an inch to the thickness of a sheet of writing paper. At other places small nodules of metallic copper occurred. These were small so it was assumed that dependence was placed on the main belt. In order to venture an accurate opinion of the belt it would be necessary to sample carefully across its width at various points and test by assay; or to be more accurate still, it would be better to run systematic mill tests of the ore. The company volunteered no opinion of the ore, and therefore no direct estimate of its value could be made. The company erected an extensive, or rather it should be said, a most elaborate plant, consisting of every modern device for the mining, milling and shipment of the ore, which may be inferred from the fact that it embraced half a dozen boilers, two Northey duplex and other pumps, elevators, jigs, etc and a railway a mile and a half in length. The machinery was good for hoisting a thousand tons per day and there was a concentrator with a 100 ton roller crusher. All these things were included in the plant of the Colonial Copper Co., and where are they today? Can it be said of the operations of the defunct Colonial Copper Co., that it is but an added instance, to the many in Nova Scotia, where the owners of a property overlooked the imperative nec-

essity of first finding accurately what lay below the ground before spending vast sums on plant on the surface? If all the capital of a company, or by far the largest portion of it is spent on the surface and little or none left for exploitation underground, there can only follow one result—failure—which hurts more than the shareholders. It affects the good name of the Province.

Referring to the Polson Lake Mine, Copper Lake, Antigonish County, a Mines Report says:—"Among other things the ore at this well known and promising property consists of chalcopyrite with some pyrites in a vein of coarsely crystalline siderite. * * * The vein varies in width from 11 to 6 feet or less, and has been traced for a considerable distance. Large samples of the ore have yielded from 5.67 to 11.70 per cent. of copper, although an average yield would of course be lower. * * The mine has been closed for several years; the long haul of some 15 miles to a shipping place being at present an obstacle to profitable mining. The tempting character, however, of these deposits and the high price of copper will doubtless prevent them from long remaining idle, and particularly if greater facilities for transport should offer."

It may be mentioned that a few years ago what was considered in some quarters a very substantial sum was offered by United States capitalists for this property. The owner treated the offer contemptuously, as he had, mistakenly in the writer's opinion placed a value on it over twenty times the amount he had been offered. This setting of exorbitant values on properties only partially developed, is probably one of the reasons why mining in Nova Scotia is not much more active than it is.

A concern that came into the province with a great flourish of trumpets was the Crown Copper Co., with headquarters at Pictou. Under promise to erect a copper smelter and engage extensively in the production of copper, the company were grant-

ed handsome concessions by the Town of Pictou. The company erected a smelter and a plant in general, which induced folks to believe that real and honest business was intended. The promoters came from the United States. The company made good pretence at opening out certain deposits in Pictou and Cumberland counties. There were, from the first, some who were dubious as to the company's bona fides. Those most interested could never obtain from the company any statement as to the quality of ore. The promoters spent money lavishly, and it may be said with rare cunning, in order to induce visitors to buy stock. Delegations or representatives of shareholders were brought to Pictou in order to witness how the promoters were using their money in the equipment of an up-to-date plant, which it truly was, at least to look at by the uninitiated. The arrival of the ore however, from the mines, after stock selling had been worked to the furthest limit, was the beginning of the end for the promoters. The character of the ore may be arrived at when it is stated that it was subsequently, after being crushed, used to grade the grounds and roadways. After what is now known to have been a fraud was made plain, some of the irate shareholders brought criminal action against the promoters who were rightly severely punished. One commendable action, from a provincial standpoint, was that the promoters were careful before the end came, to pay all debts contracted in the province. Subsequently the property fell into the hands of some of the larger shareholders, who brought a practical copper worker from Denver, Colorado. He erected a new furnace and imported some ore from Newfoundland and actually shipped a few carloads of matte to New Jersey to be refined—the only matte probably that up to that date had gone from the province. The whole affair was a nasty stock jobbing proposition out of which the promoters made big money at the expense of confiding

shareholders. The promoters were glib and smooth "operators" out to get money regardless of how it was obtained. The distance from the "mines" to the ore was in some cases 75 miles. The capital of the company was $300,000. The cost of the plant is put down at $100,000 leaving $200,000 that went into the pockets, in all probability, of the promoters.

At the Paris Exhibition of 1900, and at the subsequent Glasgow Exhibition, samples of copper from Georges River, Cape Breton, were awarded first-class diplomas. This seems to prove that there is copper in Nova Scotia of high quality: whether in quantity or not is a matter yet to have practical demonstration. Cape Breton, Inverness, Pictou, Cumberland, Colchester and Antigonish, have so far received most attention from copper prospectors. The other counties may direct attention by and bye.

Grossly exaggerated statements in reference to mineral production and exploitation generally can have no other than a baneful influence. Some seventeen years ago the Monetary Times, a paper with considerable influence said:

"Mining Engineer—who is interested in the Nova Scotia Coal, Iron, Copper and Railway Company, which holds a large number of areas in Antigonish County, says the company is building two blast furnaces and a copper smelter and will also build thirty miles of railway."

All this undertaking was purely imaginary.

Some years ago the writer was asked to make comment on a prospectus issued by a company which had been formed for copper exploitation purposes. The prospectus contained as exaggerated statements as possibly could be framed, leaving completely in the shade similar literature emanating from some of the mineral producing localities of the United States. The prospectus could not well be criticized; language was lacking to do so in appropriate terms. Here is a copy of it:—

"The mineral deposit of this company has an area of 640 acres of mineral land; the deposit consists of a horizontal bed, or blanket vein, bold outcroppings of which can be seen in various parts of the property and for a thousand feet along the bluff which forms the bank of the mines. and in numerous openings, all showing excellent extent and thickness of ore.

"The copper vein which contains the copper, gold, nickels and aluminum extend practically over the 640 acres averaging in value ten per cent. of copper yielding 8,48 tons of copper, which, at 16 cents per pound, yields a value per acre of $2,715,520, the 640 acres aggregating $1,737,952,800, each ton yielding a value of $32.00. Cost of mining, smelting and refining $7.00 per ton. Net profit per ton $25.00, giving total profit, $1,357,776,200."

"These figures do not deal with the roof rock, that carries gold below the copper vein, which has been penetrated to the depth of eleven and a half feet and runs $13.50 in gold to the ton."

There have been numerous untrustworthy, or possibly better termed "crazy" prospectuses issued in the province, but it is doubtful if the foregoing has ever been matched, not to say excelled. It is to be feared that the number of honest endeavors to develop the copper areas in the province do not equal those which have been promoted from dishonourable and dishonest motives.

It was assumed a score of years ago that ore yielding on an average five per cent. of copper would leave a fair margin of profit to the producer. Five per cent, or 100 lbs. of Copper to the short ton would at 12 cents give $12.00 per ton. At the present selling price of Copper, the return would be from thirty-five to forty five dollars per ton of ore refined; making all allowance for increased cost of labor and material, there should be large profit in copper production, as compared with possible profit twenty years ago.

OIL SHALE—OIL COAL.

It is a growing opinion that the oil shales, or oil coals of the province are bound at no distant day to command attention and claim a place as economic factors of much importance. The increasing use of oil in not only great vessels of war and large cargo carrying steamers, but in fishing craft and countless motor boats leads to the belief that the oil wells in the United States cannot long stand the drain upon them. Indeed there were exhibitions of uneasiness in some quarters within the past three years on the announcement, premature, possibly, that many of the oil wells were showing signs of becoming exhausted. Relief came with the intelligence that a new oil field had been struck in one of the southern oil producing states. Rich as these new wells may be there is little doubt that the supply of oil from the American wells will gradually decline and that the demand will be scarcely possible to meet if the use of oil continues at the present phenominal rate, and still less possible if the use of oil increases at the same rate as during the past few years.

The discovery of oil wells in the United States some sixty years ago is responsible for the stoppage of the production of oil shales or oil coals, a business which for a time presented promising features. It may be—who can tell—that just as the output from the U. S. wells diminishes, oil shale mining and, in

addition, refining, may be resumed and carried on on a scale that will make the joint industry one of the most important in the province.

There may be doubts as to the extent and quality of some of the other minerals of which it is claimed the province is the proud possessor; there is little doubt as to the extent and high quality of her oil coal and shales. One who has been taking a keen interest in the province's oil shales, in a note to the writer says:—

"I see there is the possibility of a great industry at some date, just when, it is impossible to say."

There has never been doubt expressed as to the quantity and future great value of our shales. For very many years, possibly since he had the privilege of visiting and closely inspecting one of the largest shale plants in the Lothians, the writer has often wondered that no persistent, honest, effort has been made to utilize native shales. The quantity of oil distilled from the Scottish shales he learned to be small, in many instances, in comparison with that obtained many years ago from practical tests of the Stellar Coal of Pictou County. It has been declared that there are, possibly no other shales in the province comparable with the "Stellarite" The writer however, is of the opinion that there are shales in more than one county of the province which do not come short of it in quality; but, whether or not, it can truly be said that practical tests of the shales of Antigonish and Colchester demonstrate that they yield as much oil per ton as those now being utilized in Scotland. The writer has handled samples of shale from Colchester giving every indication of being very rich in oil, but as yet lightly esteemed, for the reason there is no present use to which they can be put in the province. Very many years ago the writer was asked to examine a piece of supposed coal found in Colchester and pass opinion upon its merits. One of those who was interested in the matter applied a

match to a piece of the supposed coal, say six inches in length and about half an inch thick. Ignition immediately took place and the burning material carried round the room several times and kept blazing until extinguished. The conclusion at that time arrived at was that it was a piece of cannel and not of ordinary coal. This damped the ardour of the prospectors. Since that time, and since becoming familiar with shales, the then expressed opinion has been revised, and the sample is now classed to be that of an oil coal, having to all appearance, the characteristics of the Stellar Coal. This leads to the belief that the shales of Colchester may yet come in for the attention which has been denied them in the past.

A short time prior to the beginning of the war, British capitalists had all but come to the conclusion to become active participants in the development of oil shales. The prospects for the flotation of a company were highly promising until the war broke out. It is possible that even this event might nothave stayed proceedings had not another factor intervened, namely, the question as to the rightful possessors of the oil lands and as to who were the rightful or undisputed lessors, the owners of the soil or the local government. The present great and prospective increase in demand for oil shales attracts attention as to extent and prospective great value of the shales of the province. Not long ago, the premier of the province was somewhat brusquely asked why instead of nibbling at many little things to increase the revenue, he did not attack the subject as to the ownership of all minerals and more especially the ownership of shales. It was suggested that legislation be passed declaring all minerals of the province not now covered by license, or right of search, and in short all minerals not yet discovered whereso-ever found, be declared as the property of the crown. Were this done, it was pointed out, the action would surely result in increased revenue to

the province, if not at once at a later time. There would be nothing dishonest in this, for the reason that the original grantees, or lessees of crown lands —those leases secured before 1826—did not make application for the land for other than tillage, pastural or lumbering purposes, and never once thought of minerals. The lessees were as indifferent, shortsighted and ignorant, in respect to the future of nearly all minerals, as were the government who, in granting the leases, never had a thought as to minerals, or their value, and hence conveyed the lands without reservations. At present it is not known whether the shales, in many localities, belong to the crown or to the owners of the soil. It is said that British capitalists shown a plan of shale areas and noticing a block of land here marked "under option" and another there marked "under lease from Government" declared that the plan resembled a checker board. They declined to risk considering the scheme, seeing it was not established to whom the mineral belonged. A writer in the press holds similar views in regard to this anomaly as will be gathered from the last paragraph in the following:—

"For fifty years or more it has been known that the carboniferous shales of Nova Scotia, principally the Pictou and Antigonish formations, will produce oil. It is said by men who think they are competent to judge that, should the mineral oil wells of America go suddenly dry, there is enough reserve oil in the shales of Nova Scotia to supply the Dominion of Canada for hundreds of years.

"Whether that be correct or not, there are in Nova Scotia some of the best oil shales in the world which in all probability will sooner or later be called into use. Some of the shales of Antigonish run as high as 23 gallons of oil and 38 pounds of ammonium sulphate to the ton. In Pictou County, the Stellarite (oil coal) runs from 53 to 199 gallons to the ton, while the ordinary shales give from 14 to 42 gallons to the ton, with a production of ammon-

ium sulphate a little in excess of that of Antigonish.

"Immediate steps should be taken to ascertain the extent, the quality, and the probable cost of mining these shales, and the average production of oil per ton of shale. A portable field apparatus for determining the quantity of oil, gas and ammonium sulphate (contained in the shale) could be profitably worked and valuable data filed, that should be of use to the Government when the necessity will come to supply oil from these shales to the nation.

"Owing to the large consumption of gasoline, the use of oil as a fuel in steamships and the failure to discover new oil fields, of any magnitude, the time is not far distant when our reserve of oil will be needed, and all information relating to the productiveness of these shales, should, as early as possible, be in the possession of the Government, so that when the time comes that they will be needed, the trouble and time of prospecting, locating and proving, will be saved, and an immediate start could be made to erect reducing plants to produce oil and ammonium sulphate (fertilizer) sufficient to enrich the total farming area of Nova Scotia yearly. These shales are easily obtainable for testing as they crop to the surface.

"In Scotland, according to Dr. Ells' report, the following valuable products are manufactured from oil shales: Gas, naphtha, gasoline and motor-spirit, lamp oil ,lubricating oil, solid paraffine, smokeless fuel, and carbon for electrical purposes, sulphate of ammonia, fertilizer that sells in the United States from $60 to $75 a ton. The shales of Nova Scotia are equal to, if not better than, the shales of Scotland, and there is no reason why an industry equal to that of the Scottish oil shale industry could not be established in Nova Scotia when the demand requires it.

"The government should reserve title to all the oil shales in the province, as they are a valuable asset and of incalculable worth. Some interest is now

being shown in the licensing of oil shale areas; but it would be a mistake to lease oil shale lands, as productive oil areas, may, when the demand for oil becomes urgent, be held idle, due to litigation, as has been the case with areas held for coal, gold and other minerals. This is a matter of great national importance.. It should be dealt with by the Industrial Research Board, appointed by the Dominion Government, in the interests of the nation and the Empire."

Were the local government to adopt the suggestion contaned in the first sentence of the last paragraph good results would assuredly follow. No matter where the oil shales are located in this district, or that of any county, clear titles could be given to those seeking for shale lands. There would be no necessity for searching old records in order to ascertain who had the right to lease or sell, the shales, and if all shale was declared to be coal, who can tell, in the event of the oil industry being established, how much revenue, in the shape of royalty, would accrue to the government.

There is a wide diversity of opinion as to how the shales of the province should be classed. Some hold that certain shales are of animal origin, and others that they are mainly bituminous, while yet others declare they are ashphaltic. Asked for his opinion on this point one who has taken a scientific interest in the subject says:

"I have given considerable thought to the point as to the origin of oil shales, ashphaltic versus bituminous, but I have failed to find anything that will throw light on this phase of the subject. Analysis of oil shale running 30 per cent. volatiles, 11 fixed carbon and 8 ash is totally different from oil running 34 per cent. volatile, 62 carbon and 4 ash. Then Stellarite again, is an altogether different mineral apparently, though classed as an oil shale. Its volatile runs 66 per cent, fixed carbon 2 per cent· and ash 8.21 per cent. I have not any recent analysis

of this thing as I find that the value of an oil shale can be just as readily determined by calorific determination, as the amount of oil in the shale is directly proportionate to the B. T. U. content. There is no doubt in my mind that an oil shale can be distinguished from coal because the ash is much smaller in volume than the original coal, whereas shale ash remains the same volume as the original shale. It seems to me, by study of the crown land records in Halifax, that the oil shale belongs to the farmer, or owner of the land."

On this very point it is that doctors differ. Even those who hold that the shale goes with the soil cannot be wholly certain, as certain of them have secured options from the owners and taken out licenses from the crown. Another who is giving attention to the subject expresses the opinion that it is more than likely that the ownership of mineral oil-shale will have finally to be settled by the courts. If this happens, the development of the oil shale industry may be gravely hindered. The government has it in its power to settle the question once for all, by declaring oil shale to be the property of the crown, and that declaration made, there would be no chance for successful litigation. It has been suggested that a simple method, and one that would not be so near a semblance to expropriation or confiscation would be to make pronouncement that all shales are to be declared to be coal. Such a pronouncement might work well in counties where coal does not exist, or is not being won, such as Antigonish and Colchester, but it might be a hindrance to the development of the shale-oil industry in counties where coal mining is being extensively carried on. In several of these counties, large tracts of ground are covered by leases or rights of search for coal. Take for instance Pictou County, where coal and shale abound. Those holding coal leases covering ground in which there are rich shales, look upon coal mining as their chief, indeed, only business. If

shale be declared to be coal, then those desirous of entering into the recovery of oil from shales would be excluded, due to the fact that the areas are already covered by leases for coal. The writer is therefore of opinion that the easiest way out of the difficulty is to declare oil shales and oil coal as the property of the crown, and at the same time declare that shale is a mineral other than coal. Of course, it would be necessary to give a definition as between oil coals and coal, just as coal is called bituminous when it contains less than 70 per cent. of carbon, and is called anthracite when it contains from 80 per cent upwards of carbon.

So far as yet discovered the richest of the province's oil coals or shales is situated in Stellarton and is under lease from the crown to the Acadia Coal Co. The McGregor seam (coal) was originally worked by the old Acadia Company, which was distinct and apart from the corporation now doing business under that name. The McGregor seam was the principal working of the old Acadia Company, until the acquirement of what is known as the Acadia area at Westville. The old company had cut two seams on its areas in the Albion Mines (Stellarton) district. The other seam on the original Acadia area was the Stellar coal seam, so called, from the emission, when burning, of many small flames which spectators could easily imagine resembled miniature stars. The old Acadia sunk a pit on the seam, but made no attempt to work it, as the product was not in demand during their holding of the lease; nor has any attempt to work it been made by the present company. There are several seams overlying the Stellar seam, which places it at a disadvantage at the present time, and until such time as the overlying seams have been well worked to the deep. Fortunately coal similar to the Stellar, if not the same seam, is found on the east side of the East River, and as there are no coal mines in the vicinity this oil coal could be mined at any time.

Possibly had the Stellar been an overlying or top seam, a sale of the lease might have been made before this, and a plant for the distillation of oil in operation. Nigh twenty years ago, the writer was commissioned by the one who played the chief part in bringing about the amalgamation under one head of the Southern C. B. Collieries to go to N. B., and secure leases on areas known or supposed to be underlaid with oil shales. This was done. He was then asked to approach the agent of the Acadia Coal Company and find out if the company would lease the Stellar seam. He was asked to make a definite proposal. This was done. After a time the answer of the company came, which, in substance, was that they were open to an offer for all the property but not for a part, the working of which might injuriously affect the other parts. Those interested in oil shales did not wish to go into the coal business, and as no answer could be made to the allegation that the lease of a part would injure the other part, negotiations dropped. Those who had an eye on the Stellar seam, were United States capitalists.

Without any idea of minimizing the quality of other oil coals or shales in other districts, a lengthy reference to the Stellar coal is permissible in view of the fact that all authorities, who have interested themselves in the subject, are of the opinion that the oil shales of Pictou County, and more particularly the Stellarite, which is not confined to one particular spot in the county, are of great prospective value.

Many years before the shales of New Brunswick and Nova Scotia had been given attention to by the Geological Survey, and before earnest attempts to interest capitalists in our shales had been made, the writer had an article on the subject published, of which the following is the substance:—

"When the folk residing in the Albion Mines district decided to give the place a new name and decided that the name should be Stellarton, was it

a case of building better than they knew? Was it an inspiration that the new town should have a name identifying it with a peculiar mineral found within its proposed bounds? Was there prophetic gift in the selection, carrying with it the belief that though the particular mineral was then lying idle, owing to the discovery of oil wells in the United States, to which the largest quantity of the Stellarite formerly mined had been sent; the time would come again when the mining of Stellarite would be resumed and Stellarton become more famous for its oil-shale works than for its many coal seams even though one of these was no less in thickness than forty-five feet, and a wonder to all coal men on the continent. Can it be called a mere day dream which has in it not only the mere possibility but probability of future fulfilment? Is it an impossible thing that Stellarton having the material, in richest quality and abundance, may not yet, some day in the short or long future, rival the Lothians as a producer, from shales and coals, of oil, crude and refined, of many kinds, and of candles of every hue of colour, which will find a ready market in countries scattered over the face of the globe? There are those who hope, indeed who believe that Stellarton may some day become the centre for the distillation of oils from shales and oil coals. Among these is Mr. Hartley, an admitted authority on shales, and one of the comparatively few who have earnestly studied the subject. Referring to the Stellar coal, Mr. Hartley says:—

"The principal value of the seam consists in the large quantity of oil contained in the benches, mentioned as oil coal, in the general section which in former years was extensively worked. The oil coal or Stellarite, as it has been called by Professor Henry How, who first described it, as selling for a high price for gas making and distillation." Mr. Hartley further says: "From pits sunk by the Acadia Coal Co., it would appear that the size and

quality of the oil coal bench improves towards the east. In a pit sunk some distance from the Fraser mine the oil coal was found to be 1.10". From the bench 120 gallons of Crude oil to the ton were produced, while the average of the Fraser mine to the west was 60 to 65 gallons per ton. According to the Geological Report the Stellarton Oil Coal has the following section:—

Good Coal, 1 ft. 4 in.
Stellar Coal, 1 ft. 10 in.
Bituminous shale, 1 ft. 10 in.

From the three benches Prof. How obtained the following results:—

	Coal	Stellarite	Shale
Volatile matter	33.58	66.56	30.65
Fixed Carbon	62.09	25.23	10.88
Ash	4.33	8.21	58·47

In reference to the Stellarite it has been said:—

"This peculiar substance was first known and worked in the Mines by the late J. D. B. Fraser of Pictou. It appeared to be an earthy bitumen, or to quote Dr. Dawson a fossil swamp, mush or mud, which he declares is the character of the earthy bitumens, and highly bituminous shales of the coal formation generally.

The bituminous shale referred to is of a rather heavy brownish black colour. The following analyses and remarks thereon include both the bench and Stellarite. The first series is taken from reports of Mr. Hoyt to the (old) Acadia Coal Co., in 1866. The analyses under the heading of No. 1 refer to the Stellarite and under No. 2 to the shale:—

	No. 1	No. 2
Volatile Matter	68.38	38.69
Fixed Carbon	22.35	8.26
Ash	8.96	52.20
Sulphur	.05	.25
Moistures	.32	.60
Specific Gravity	1.079	1.568

Wt. p. cub. ft.	67 1-2 lbs.	97. lb.
Crude oil per ton	126 galls	63 galls.
Gravity of oil	.844	.856
Coke per cent.	31.25	60.46

Prof. How's analyses differ slightly:

Volatile matter	66.33
Fixed Carbon	25.23
Ash	8.21
Moisture	0.23 p.c.

The samples of Stellarite to which the foregoing analyses refer, yielded 126 gallons Crude Oil per ton. Dr. Dawson in his Acadian Geology referring to the Stellarite Coal says that "the amount of Petroleum obtained from wells in Canada and the United States has for the present diminished the demand for the earthy bitumen, but it is certain that it must again come largely into use as the wells diminish their yields and additional uses are found for the mineral oils."

In the 1869 Geological Survey Report, Sir W. E. Logan and Edward Hartley describe the Stellar coal as occurring at several places in the county. It is found at Marsh Brook in a pit opened by Mr. Halliburton, the thickness of the seam being given at 4 feet approximately. At this spot carbonaceous shale is found in large quantity. It is also found in several places on McLellan's Brook. One seam in that vicinity varies from one to as high as eight feet. Associated with the Stellarite are black carbonaceous and other shales. Old miners speak of a pit that was opened up at McLellan's Brook by Mr. Patrick. The seam varied in thickness from 2 to 6 feet. The best of the coal in this slope was "curly" a name sometimes applied to the Stellar coal. It is claimed that the variations—the thinning and the thickening, in the seam, arise from depressions on the upper portion which are filled up with even layers of the more ordinary carbonaceous shales.

Mr. Hartley in his report says:—"From pits sunk by the Acadia Coal Co., it would appear that

the size and quality of the oil coal bench improves towards the east, the greatest thickness (1.10") being procured from a pit sunk at the corner of Grove Street and Pennsylvania Avenue in Acadia Village —presumably that part of Stellarton which is familiarly termed "The Asphalt," which coal produced 120 gallons to the ton; the average yield from the Fraser Mine being between 60 and 70 gallons.

In order to arrive at something approaching an accurate idea of the value of the Stellarite, as an oil producer, the following table condensed is taken from How's Mineralogy of Nova Scotia:

The table shows the oil contents of Shales won in different countries and a comparison is informative and interesting:

	Galls. Oil per ton
Union Oil Coal W. Va.	32
Elk River Oil Coal	54
Kanawho Oil Coal	88
Scottish Cannel	40
N. B. Albertite	92to 100
Torbanite, Scotland	116 to 125
Stellarite, N. S.	53
Stellarite, . S., No. 2	50 to 74
Stellarite, N. S., No. 1	123 to 126
Samples Picked	199

From this it is seen that the Stellarite is better than the majority and not any inferior to the best. Fuller analyses given by Prof. How show that there is much similarity as to oil contents and value in the Torbanite, Stellarite and Albertite Coals, Shales or Minerals, or whatever names they go by. The County, next to Pictou, known, for certain, to contain oil shales of value is Antigonish. A large amount of prospecting has been done with varying yet encouraging, results. A great rush for oil shale areas in this county took place a few years ago, but nothing definite resulted, due, principally, to the fact that in one district coals were reserved by the

crown, and in the district adjoining, all minerals but coal were the property of the owners of the soil. Those chiefly interested in the matter got weary of running about from farm to farm in an effort to discover the actual owners of the shale in order to make sure, in the event of shale not being included in the term "coal."

The following references to what is known of Antigonish shales is gleaned from Geological Reports, and other available sources.

A short distance east of Maryville and outside of the Arisaig-Antigonish district drilling and mining have proven the existence of considerable beds of oil shale. Dr. Ells in his report of 1910 describes these, and quotes Prof. How for the statement that the shales are found in two groups, the lower 70 to 80 ft. in thickness including 20 ft. of good oil shale 5 feet of which are curly cannel rich in oil; the upper 156 feet thick, in immediate contact with the limestone, and containing a larger percentage of oil. Of the 5 feet of Curly Cannel Prof. How states that it will yield, at least, 40 gallons of crude oil per ton and fifteen feet of the remainder will yield at least 20 gallons.

In the vicinity of Maryville and Pleasant Valley oil shales have been exposed in a number of pits and prospecting was carried on by a core drill.

At Pleasant Valley and South of Maryville, the shales appear to be at low angles, and the oil shale probably is not deeply buried.

Of the oil shales in Cape Breton County sufficient is not known to make anything like an approximate as to their value. It has been for a long time asserted that there are promising oil shales at East Bay. If really the mineral is to be found in that locality then its quality has been greatly disparaged by the action of a certain concern which made large and somewhat loud pretence of undertaking operations for the distillation of oil from the shale and the erection of a refinery. There must have been

slick operators among the promoters of the company. Their much boasting deceived even the reserved and staid officials of the Nova Scotia Mines Department, the practical head of which declared that operations so far at East Bay led to the promise that shales of rare value would be discovered in the immediate neighborhood of the plant and in the vicinity. After a time the Mines Department growing suspicious that more talk than testing was being done sent down an expert quietly to make a sort of semi-official report. The visit was made and a report forthcoming which was wholly disconcerting. There was no oil being produced from shale, for the very good reason that there were no visible oil shales at the plant from which to extract it. But, said the visitor, that does not say that the promoters made wholly untruthful statements. They had made heroic, or foolish, attempts to extract oil from a coal which in former days went by the name of Sydney-Reserve Coal. The visitor was so shocked by his discovery that he omitted to ask how many gallons to the ton this coal produced. The information certainly would have been useful. Asked if the undertaking was a fraud from beginning to end, the expert answered cautiously that he was not prepared to declare to which of the two, the great frauds or the great fools, classes the promotors belonged. Those who put money in this undertaking were people from across the line. It is curious, in a way, how Nova Scotia has been selected on several occasions as the scene for wild-cat schemes. The only approach to a satisfactory answer is, that up to within a few years ago Nova Scotia was all but an undiscovered country to folks living beyond its bounds. This lack of knowledge was taken advantage of by sharpers. A lesson even in economics may be had from the old saw about far away birds and fine feathers and the other about the enchantment exercised by distance.

Little, if anything has been written regarding

the oil shales of Colchester County, for the reason that while there has been much exploitation for coal, and even for gas, there has been none for shale. And yet the possibility, may it not rather be said probability, is that this county possesses as rich oil shale as any in the Eastern provinces. It is known that there are numerous thin seams of "coal" in the county which have, on account of this thinness, never been worked. It is possible that several of these seams sought for as and supposed to be, coal, are oil shales, or oil coals of rich value as oil producers, while they may not be presently in the class of merchantable coal.

It must not be overlooked that the value of shales does not depend wholly on the yield of oil. Much of the recent and present increased value depends upon the percentage of ammonia, a bye product, forming, with an admixture of sulphuric acid, a most valuable and profit making material. The amount of paraffin-wax is also a potent factor in regard to profits. The amount of crude oil obtained from the Scottish shales seldom exceeds 30 to 40 gallons per ton, and shales of lower oil content are retorted, because the yield of ammonia is held to be larger in shales poor in oil than from those yielding a larger quantity.

Writing of the origin of oil shales, Dr. Ells in a Geological Report has this to say:—"As for the origin of the shale beds they are now generally regarded as having been deposited in the form of fine clays, at the bottom of lagoons or swamps, with frequently much vegetable and sometimes much animal matter, the latter chiefly in the form of fishes, as can be readily observed in many collections of fossils made from the shales both in Scotland and America. It is, however, not necessary to suppose that the oils or bituminus matters are the result of the decomposition of such organisms. The more plausible theory, put forth by Mr. Stewart, that the deposits in swamp or lake bottoms have been sub-

jected to macceration and microbic action. Part would be decomposed and only what would withstand the water, etc., would remain. This mode of decomposition agrees very closely to that suggested by Sir W. E. Dawson some years ago, who regarded the oil shales of Eastern Canada as originating in swampy lagoons, and that the resulting bituminous matter was the result of the decomposition of various organisms enclosed in the original clayey mush at the bottom of the swamp. In this case also the oily contents may have been subjected to a form of natural distillation.

Oil shales may therefore be composed of:

(1) Vegetable matter which has been made into a pulp by macceration with water and preserved by combining with the salts in solution.

(2) Richer material of many kinds such as spores which nature has provided with means for some protection against decay, and

(3) a proportion of mineral matter."

Reviewing the literature of the subject, Dr. Ells remarks:—

"We may therefore conclude that the probable origin of these shales and of their bitumen contents, as just stated, may be accounted for on a fair basis of reason, and that the origin of petroleum in shales is the result of fermentation and decomposition on the surface through microbic action." Natural gas, it may be remarked, is found in the New Brunswick shale and is now being utilized.

The above description of the origin of shales scarcely satisfy the lay mind; there are many points not covered. The fact that shales may have a proportion of animal matter, is not sufficient to debar them from being classed as coal. Were there swamps on the top of swamps formed through the process of time?" There are several seams of coal overlying the Stellarite, and there are several seams underlying it. The Stellarite, or coal similar, has not been found in the coals underlying. However, an

explanation may be possible by the geologists.

It may be asked: "Are the Stellar Coal and the Shale of any value apart from their oil producing qualities? Yes. As an enricher of gas they should be of value more especially the former. In order at times to bring gas up to the required candle power for illuminating purposes, it is necessary, frequently, to add enrichers, in the shape of oil, or very high gas producing coal. Oil shales are, at times, used instead of the oil itself. The Stellarite could well be used as an enricher and thereby displace the coal imported, by the Montreal and other gas companies, for the alleged purpose of enriching the coals from Cape Breton, used in gas making. Stellarite not only yields a high per centage of gas, but the candle power of the gas produced should make it very valuable as a mixer. The yield of gas from a ton of ordinary coal is from 7,500 to 10,000 cubic feet, and the average candle power of such gas is from 14 to 16 candles. In practical tests made of the Stellar coal it yielded 11,000 feet of gas of the very high quality of thirty-six candle power, or more than double that of average gas coals. The oil shale yields 8,000 feet of gas per ton. That is a little better than some coals, but then the candle power was thirty, which makes it excellent as an enricher. It might be unprofitable to use the Stellar coal alone, in producing gas, as the coke from it, and also from the shale, is useless. So satisfactory were the results of the Stellarite when the seam was worked, and the coal shipped to the United States some sixty years ago, that plans had been prepared for the erection of a distillory at New Glasgow. The oil well discoveries were made when the work of operation was about to begin, when, of necessity, operations ceased.

As the Stellar Coal underlies several seams of coal now being worked, the owners of the coal areas may decline to entertain any proposition to lease

the Stellarite to any party who might desire the seam for the purpose of oil distillation. In that case the Acadia Company itself might work the seam and sell the product to the gas companies, for the purpose named, and thereby render it unnecessary for the gas companies to import coals for the purpose of enriching.

The following paragraphs are selected from an article by President Alderson in the Colorado School of Mines Quarterly:

Oil shale virtually contains no oil as such. It is a consolidated mud or clay deposit from which petroleum is obtained by distillation. In appearance the shale is black, or brownish-black, but on weathered surfaces it is white or gray. It is usually fine-grained, with some lime and occasionally sand. It is tough but, in thin sections, friable. When broken to a fresh surface it may give an odor like petroleum. Thin rich pieces may burn with a sooty flame.

The total stock of crude oil on hand in the United States, January 1, 1916, was 198,000,000 barrels. On November 1, 1917, this supply had been reduced to 158,000,000 barrels. The consumption of crude oil by Pacific refineries has been exceeding the production at the rate of a million barrels a month for the past year. There is no hope that the oil wells will last permanently. The world's supply is being rapidly exhausted. The production in the United States is not expected to last more than twenty-five years. As a matter of economic necessity the oil shales must be regarded as our great reserve of oil for the future.

Inasmuch as the oil-shale industry has been in operation in Scotland since 1850—sixty-eight years—and has met and overcome technical, trade, and economic obstacles, it seems a mere matter of common sense for the pioneers of the industry in Colorado first to follow the well known and successful methods of Scotland; to adapt these methods to

Colorado conditions, and then to improve them as fast as possible by methods not now known. Besides the production of crude oil, gas, and ammonium sulphate, other possibilities may open, e.g., the nitrogen may be reclaimed in a form for use in the manufacture of munitions of war; aniline dyes and flotation oils may be obtained, possibly producer gas, a substitute for rubber, and other products may become valuable. The nitrogen content is especially valuable, as each per cent of nitrogen will yield theoretically 93 pounds of ammonium sulphate now worth 7.3 cents a pound. All in all, it should be realized that the oil-shale industry presents a long series of interesting technical-chemical problems to be solved by scientifically trained men. So true is this that the industry can be classed as a combined mining-chemical-manufacturing project.

In some quarters there exist two erroneous ideas, viz., that the distillation of oil from shale is a simple process and that a treatment once devised will apply to all oil shales. To be sure, in a laboratory retort a few pounds of shale can be heated and a small amount of oil produced. So can water be boiled in a tea kettle but there is as much difference between this puny outfit and the great plants in Scotland as there is between the tea kettle and a great central power plant. Also shales vary to such an extent that each deposit should be tested in a careful, scientific manner, just as large bodies of low grade copper ore are tested and suitable treatment plants erected. As in handling low-grade ores, the large profits from oil shale will be made by handling a great tonnage at a low cost to the ton.

The Scottish oil shale seldom exceeds 30 gallons a ton, and shale yielding only 15 gallons is successfully treated. The explanation for this lies in the fact that crude oil is not the only product of value that may be obtained. The ammonium sulphate is also valuable. If this is obtained in large quantity, as in the case of shales now being treated,

the total result in crude oil, plus ammonium sulphate, may be economically profitable. The following series of products are secured from the Scotch shales:

1. Permanent gases used for fuel under retorts.
2. Naphtha, gasoline, and motor spirits.
3. Burning or lamp oil.
4. Intermediate oil used for gas-making.
5. Lubricating oil.
6. Solid parafine.
7. Still grease.
8. Still coke, which contains some oil and is used for gas, smokeless fuel, and carbon for electrical purposes.
9. Liquid fuel used in the refineries.

Oil from shales may not possibly now compete commercially with oil from wells. However, the increased demand for oil, the decreasing production, the steadily enhanced price on the one hand will be met by an almost inexhaustible supply of oil shale, cheap mining, improved methods of distillation and valuable by-products, which will undoubtedly, in the very near future, make the oil shale industry a strong competitor of the oil well and in the by no means distant future its successor.

The oil shale industry is not, in ordinary parlance, "a poor man's game." The technical and chemical problems are numerous and require a high grade of scientific ability for their solution.

A plant of 500 tons daily capacity is as small as can be operated permanently and successfully, as the profits will depend chiefly on the large tonnage handled. In this respect the oil shale industry bears the same relation to oil that Utah Copper and the other copper porphyries bear to copper.

An investment of $150,000.00 is as small as can be safely counted upon to make a single project successful.

Until recently, on this side of the water, the shales yielding the highest per centage of oil were regarded as of the greatest value, and therefore attracted the greater attention of writers having shales as their subject. Of late years, the demand for Sulphate of Ammonia for fertilizing purposes has been rapidly extending, and as its usefulness, for such purpose, becomes more generally known, the utilization of shales for this bye-product, is bound to be extensive, and to keep on increasing. Those interested in the production of Sulphate Ammonium have more regard for shales yielding a moderate quantity of oil, than from rich oil producers. As stated those shales which were at one time classed as inferior, that is, yielding from fifteen to thirty-five gallons of oil to the ton, are now being actively enquired after, for the reason that it is now held that the richer the shale—in oil—the less the production of ammonium.

The shales of Nova Scotia are now attracting some little attention in the United States. A large concern there interested in the erection of plants for the production of oil and, more especially, Sulphate of Ammonia, has had a representative in the province enquiring about and making cursory examination of certain shale deposits, preliminary to a more thorough investigation. When spoken to of the Stellar oil coal he said that was not the sort of oil producer he was after; that its yield of oil was too high. He was on the look-out for ordinary oil shales, and if a promising property could be secured, in the district, his company might locate in Pictou County. The increasing demand for Sulphate of Ammonia made necessary the searching out of shales that would yield largely of that bye-product. He further hinted that if a plant were established it would be no small affair, but one capable of handling a very large tonnage daily. Of course it is not well to build high hopes of immediate action, nor accept implicitly the spoken word of every visitor.

Nova Scotia has had its own share of disappointments. Still the prospect of a great future for the province's oil shales never was so cheering.

Before the war Sulphate of Ammonia sold at $60 a ton

and the five big works in Scotland exported abouut 54,000 tons annually, principally to the United States and Japan. The United States Geological Survey estimates that there are 300,000,000 tons of this in shale deposits of this country, or nearly enough to fertilize the whole Mississippi valley. This bye-product is so readily salable and so much in demand that it helps considerably to cut down the difference in expense in securing oil from rocks and from wells.

So far, curious to relate, no estimate has as yet been made of the tonnage of the oil shales of the province, and that cannot well be done, for the simple reason that no one, in or out of Nova Scotia, has anything like a comprehensive idea of the several localities in which shale may be found. There is, it is believed, coal shales scattered over a large portion of Antigonish, as already stated, but no approximate as to quantity has ever been attempted, and it is worse as regards Colchester, for neither analysis as to quality, nor extent of territory covered, is given in any generally known official record. As regards Pictou County, while no estimate as to quantity has been given, data may be had which may lead some to make attempts to estimate quality. It has been demonstrated that Pictou has high oil producers, and, as there are shales of many varieties, there can be little doubt that the county has shale suitable for the production of Sulphate of Ammonia.

In a conversation about shales the writer was asked what reasons he had for being optimistic over the large quantity of shale on the Stellarton side of the East River, and also on the Eastern side. The writer replied as follows:—"Did you ever know a case similar to that which was common in Stellarton, say seventy-five years ago? In summer the guid wivesdug a hole on the banks of the river, set up a tripoid, on this they hung a wash boiler, filled it with water, lighted the gas issuing from the hole they had dug, and got boiling water without sweating over the kitchen fire. In winter time a hole was cut in the ice and the escaping gas similiarly utilized."

"But," was the further question, "did not that gas come from the seam of coal underneath, which was of a highly

gassy nature?"

"I cannot think so," was the reply." Gas was never found, so far as I am aware, issuing through the surface overlying any other mine in the province. I am not in a position to say it did not come from the coal, but if it did the strata overlying the seam must be very open, in all probability shale, and it is my opinion that the fires which have been burning for generations in the mines which had to be abandoned from one cause or other—and the fumes of which were smelled for years on the surface—while they may have had their origin in the coal seam, had their continuance in the shale, fed from oxygen which oozed through from the surface and fed the shales, and not the coal fires in the seams." Be that as it may, between the coal seams and the surface, and between one of the many coal seams and the others, the strata is principally shales. This has been demonstrated by borings made within the past two or three years, by the Acadia Coal Co. We give below the results of the borings at certain depths, which are sufficient to give a general idea of the strata in the Stellarton district. In a bore hole put down by the Acadia Coal Co., in 1916-17 from the Cage pit, in search of coal, the following strata was passed through. The total depth of the hole was 302 feet. Let 276 feet of this depth be taken:—

Coal	Coal & Shale	Gray & dark Gray Shale	Black Shale	Sandstone	Clay & Ironstone
16 ft.	24 ft.	98 ft.	26 ft.	67ft.	24 ft.

In the 276 feet bored, the strata consisted—inches omitted—of 164 feet coal and shale, 86 ft. of standstone, and 23 ft. ironstone and grey clay. Two of the sandstone seams were 26 and 25 ft. respectively in thickness.

The different strata are remarkably consistent in their occurence as will be gathered from the following section which begins after the hole had reached a depth of 206 ft. This boring was done from the No. 6 level of the McGregor seam.

Depth	Measures	Thickness		Depth	Measures	Thickness	
210	Black Shale	3 ft	5 in.	272	Shale	9 ft.	3 in.
215	Coal	5	0	279	Sandstone	7	2
223	Black Shale	8	0	284	Shale	4	7
228	Black Shale	5	9	285	Sandstone	1	5
247	Grey Shale	18	3	293	Clay	7	8
248	Coal	1	4	296	D G. Shale	3	2
253	Coal	5	2	299	Sandstone	2	8
257	Shale	4	0	306	Clay	7	0
263	Sandstone	5	7	315	D. G. Shale	9	2

316 ft. coarse coal 1 ft. 5 in. 318 ft. dark shale 2.3.

Take the same bore hole at a depth of 699 ft.

Depth	ft.	in.
699 ft. Black shale bands of coal	2	2
700.1 ft. Coal	1	2
718.6 ft. Grey shale	17	8
725.8 ft. Dark grey shale	7	2
740.10 ft. Coarse coal	24	2
751 ft. Dark grey shale	1	3
771 ft. Grey shale	19	11
775.4 ft. Grey sandstone	4	2
780.6 ft. Grey shale	4	10
788.2 ft. Dark grey shale and coal	8	2
791.4 ft. Coarse coal	3	2
793.7 ft. Grey shale	2	3
801.0 ft. Coal	7	5
801.6 ft. Black shale	0	6
811.2 ft. Coal	9	8
815.2 ft. Grey shale	4	0
846.0 ft. Dark grey shale	31	4
855.6 ft. Hard shale bands coal	9	0
862.6 ft. Hard shale bands coal	7	0
870.6 ft. Hard shale bands coal	8	0
875 ft. Hard shale bands coal	4	10

Deducting the sandstone and ironstone, and including the black and dark grey shales which have bands of ironstone, the strata underlying the McGregor seam is composed of shale of a thickness of close on 800 ft. This is entitled to be called an underground mountain of shale.

A writer in an American magazine lately asked the question:—

"Are our petroleum fields showing signs of exhaustion?" The output of petroleum has not yet begun to

diminish, yet the downward trend of production from the present oil wells is plainly in sight. . . No great oil regions comparable with the mid continent, or California fields, are being discovered, and it is questionable whether any will be, for oil geologists have pretty thoroughly combed the accessible oil areas. What then is the answer?

"It is just at this juncture that we have made a discovery that has disclosed what is undoubtedly one of our greatest mineral resources, one that should supply the needs of the war, and for generations to come will enable the United States to maintain its supremacy over the rest of the world, as a producer of crude oil, and gasoline, and incidently, of ammonia as a highly valuable bye-product. We have discovered that we have mountain ranges of rock that will yield billions of barrels of oil."

Well, what they have just discovered in the United States we in Nova Scotia have known for long to be the possession of the province.

Quoting further from the article we read:—

"In connection with its investigations of the undeveloped mineral resources of the country the United States Geological Survey has recently made special studies and tests of these oil rocks, and has brought to light two important facts:—First, that our western shales are phenomenally rich in oil, and second that in foreign countries, particularly Scotland, much inferior shales are today successfully mined and worked, as a source of oil and other commercial products. The industry in Scotland is 70 years old and is still in a highly flourishing condition."

And here the remark may fit in that the U. S. Geological Survey will have to do "some" investigating before it will disclose a coal like the Stellarite, or shales which, under practical tests, yielded an average of sixty gallons to the ton.

Further the magazine writer emphasizes, what has been stated previously under this chapter. He writes, "The Scotch (Scottish is meant) shales yield 25 gallons to the ton, yet the principal operating companies competing with the petroleum industry pay dividends averaging eighteen

per cent,, rock producing even as low as 20 gallons of oil a ton yielding good dividends. The shales in the western United States are far richer thon those of Scotland. Many tests made by the Geological Survey show that the American rocks contain 40 to 50 gallons to the ton and those in one deposit tested 90 gallons, or more than 2 barrels to the ton."

A safe comment on the foregoing may be that the shales and oil coal have been tested, and the tests demonstrate that there is no shale in the Western States, not to speak of the Scottish shales, comparable to them. Picked samples of the Stellarite showed this coal to be three times as rich as the alleged average in the United States and twice as rich in oil as the one rich tested deposit in the United States.

The people of Nova Scotia have not begun to realize, indeed they have taken slight notice of the immense value her shales may be to the province. Long ago the writer stated that the province would, at a later time, rise to a proper conception of their great value, and that time is coming very near, that is, if her people have wit and foresight enough to rise to the occasion. The extraordinary demand for oil, coupled with the expected diminishing production of the wells, which it is freely asserted, is within measurable distance of being a negligible quantity, will surely stimulate much more interest being taken in this mineral than at any previous time. Experiments in the utilization of oil shales are being made across the line. In Colorado oil is being distilled, new plants erected, and experiments, after new processes, are being carried on vigorously.

To paraphrase what has been written in respect to the shales of the United States, one might say—"Nova Scotia is indeed a country blessed by a generous Providence. Germany to supplement its stock of petroleum and gasoline laboriously raises potatoes from which to distill feul alcohol, but here in Nova Scotia there are immense bodies of oil shales, which can easily be won and transported to distilleries and retorts which will turn out oils and fertilizers in unlimited quantities."

The immense increase in railroad traffic due to the active participation of the United States in the war increased correspondingly the quantity of petroleum and of petroleum distillates consumed as locomotive fuel in 1917, despite their mounting cost and growing scarcity.

Statistics compiled under the supervision of J. Northrop, of the United States Geological Survey, Department of the Interior, from reports submitted by all railroad companies that operated oil-burning locomotives in the United States show that the quantity of fuel oil consumed by them in 1917 was 45,707,082 barrels, a gain of 3,580,665 barrels, or 8.5 per cent. over 1916 and a larger consumption than in any other year.

GOLD.

There is the lure of the woods, and the lure of the wilds, but a greater than either is the lure of gold—the mineral. Announce the discovery of gold in any country and there follows a mad rush for the locality. It was thus in the case of the discovery of gold, in California, in the Yukon, and in Alaska. Nova Scotia had a slight attack of the gold fever in the sixties, and subsequently, of last century, but of a comparatively mild type.

Why has gold hunting so great an attraction for prospectors, and even those who cannot distinguish road metal from quartz? It is surprising seeing there is so little money in it, and these days, money, alas, is the test, not only of materials but men.

A magazine writer, some years ago, made the assertion that, the world over, it has cost probably a dollar to produce fifty cents worth of gold. Lately a somewhat similar statement has been made. It has been declared that for every dollar sent into Alaska only fifty cents were taken out. It might not be correct to say that these statements could well apply to Nova Scotia, and that the cost of production was twice the market value of the product, but it may not be wide of the mark to say that so far as the history of gold mining in the province goes, it has cost a full dollar to produce its equivalent in gold. Were it possible to summon to one spot all who have in the province dabbled in gold, and put

the question to them—"How much did you invest in the exploitation of gold areas, and what were your returns?" it is probable the reply from a majority would be—"The outlay was greater than the income," while many would declare—"It was all outlay and no income. When the gold fever was more or less epidemic, in the years following its discovery at Mooseland, investors in gold lands were to be found in all localities. Why? The reason is not far to seek. First of all there is the "get rich quick" spirit; then there is the tendency to speculation, inherent in very many people, if not in all. The uncertain quantity in gold mining has for some a strange, and a strong fascination. People, as a rule, are unwilling to admit it, and yet a majority, at least at odd times, dearly love a gamble, be it mild or bold. For those who have compunctions to bet on a horse race, there is a way of escape, to indulge an inherent propensity, by investing in gold chasings. People, happily, have largely got away from the old idea that there is any probability of securing sudden wealth by a "lucky strike." The bump of gold getting must be shorn of the element of speculation, so far as that is possible. It must now be entered upon as a business, which, diligently prosecuted and efficiently managed, will yield a fair, and not a fabulous, return. Before there can be a return to anything like the activity of fifty years ago, it must be demonstrated by honest and intelligent operation, that the gold business like any other, can only be made profitable when business methods are applied in its prosecution. It has been asserted that in order to make sales of stock, tricks have been resorted to by promotors even in Nova Scotia, equivalent to the "salting" one reads of as having been done in other countries. There, no doubt, have been transactions in gold areas and mines which have cost Nova Scotia much in reputation; and that is what the province cannot afford. Some of these transactions may be referred to in a later chapter.

Of late years, the Lieut. Governor of the province,

in his speeeh at the opening of the Legislature, has referred with regret to the "deeline of gold mining," and people in referring to the subjeet use similar language. The phrase is somewhat misleading. As a matter of fact gold "mining" has not declined to the extent many imagine, though the yield of gold per ton of quartz shows a disappointing deeline. The variableness of the yield is somewhat surprising. In 1862, the first year for whieh there is official return, the yield of gold per ton was a little over an ounee and two and a half dwts. Twenty years after, with twiee the quantity crushed, the yield was an ounee and a little over 3 dwts. That was the best year's crushing in the history of gold mining. The biggest crushing was in 1902 when no less than 192,074 tons were crushed, with a yield of less than three pennyweight per ton. There was twiee the quantity crushed that year than in any year suceeeding. The total quantity of quartz crushed since 1862 is say 2,300,000 tons, and the yield of gold approximately 960,000 ounces of the value of about $19,200,000. There were more tons of quartz crushed in 1912 than in 1882, whieh is proof that in recent years rich surface finds have disappeared.

The geological formations of the province range from the Cambrian to the Triassic. The lower Silurian, now more commonly called the Ordorician, which underlies the southern eoast of the provinee gives us our gold deposits. The Upper Silurian and the Devonian systems, farther inland, give us our iron and eopper ores; and the Carboniferous system furnishes us with our great coal deposits, gypsum, and limestone.

A line drawn from White Point in Guysboro County to Stewiacke and another drawn from Stewiaeke to High Head in Yarmouth County mark roughly the northern boundary of the gold bearing roeks, and is the dividing line, praetieally, between the Lower Silurian formation and the others. The area covered by the Lower Silurian is 250 miles long, about 8 miles wide at its eastern end, and not

less than 50 miles at its western extremity, and contains about 6000 square miles. The thickness of the gold bearing rocks are shown by Professor Hind to be about 9,000 feet, and the upper or ferruginous slate division, 3,000 feet.

The whole of the gold-bearing country is much faulted and thrown into sharp anticlines, the steepest sides of which are to the north, except at Sherbrooke, and a few other places, the steepest sides are to the south. The formation is traversed by masses of eruptive granite, and the most productive gold veins are near the granite intrusions. This has led many of the geologists, among whom is Dawson, to believe that the granite intrusions and the gold veins were formed at the same time,

The course of the anticlines is, roughly, east and west, and the gold has been found to be more plentiful in the sides and the summits of the anticlines, while in the synclines the unproductive slates appear.

The gold veins are in thickness from an inch to eight feet or more, and are not regular in thickness. This latter condition is due to them having to occupy irregular or faulted spaces in the beds. It is not easy from inspection of the vein to tell its value, as in many valuable veins the gold is invisible.' It has been decided however that the milky-white quartz is not a good carrier of gold; the most productive is grey or of leaden color and associated with sulphide, the decomposition of which gives the quartz a stained color.

Although small showings of gold had been found previously to 1860, it was not until the Spring of that year that it was discovered in quantities to attract the attention of the public. John G. Pulsiver of Musquodoboit, accompanied by Joe Paul, an Indian guide, found large quantities of quartz, carrying gold, at Mooseland on the Tangier River. He immediately went to Halifax to report his discovery and on his way found other places equally rich. In the same year, Peter Mason found gold at the head

of Tangier Harbor. Samples of quartz shown to the government officials failed to interest them. However, the rush of men into Mooseland and Tangier, in 1861 and the continuous discoveries of that year, forced the government to act, and Mooseland and Tangier were proclaimed gold districts, and were surveyed in April 1861. Gold has been continuously mined in the province every year since 1861. For five years after the discovery, the production did not meet the expectations of the operators; but in 1867 the production reached 27,314 ounces, 11 dwt, 11 grs. This created great excitement and speculation became rife. English and American capitalists came in and conditions were created that reduced the production from that of 1867, to 9,140 ounces, 13 dwt, 9 grs, in 1874. The reasons for the decline in the gold output are given in the Canadian Geological Survey report of progress 1870-1871 by Alfred R. C. Selwyn.

First—The rash expenditure of capital in the purchase of mining rights respecting the actual value of which nothing is known with certainty.

Second—The hasty and inconsiderate erection of costly machinery for mining and treating the ores, before their quantity or their probable value has been determined.

Third—The attempts frequently made to enhance the value of the stock by declaring dividends, sometimes paid out of capital but often by means of a process commonly known as "picking the eyes out of a mine," or in other words, selecting all the rich material to secure a few high yields which are far in excess of anything likely to be the future average.

Fourth—The too common, almost universal, practice of devoting the whole of the net proceeds to the payment of dividends, and having no reserve fund to meet expenses when poor ground has to be worked through.

Fifth—The small size of the areas or claims, not as regards actual acreage, but in relation to the position and thickness of the veins. This necessitates

the wasteful multiplication of shafts and plants of machinery for crushing and dressing the ores.

Sixth—The disregard of the natural features of the ground, shown in locating the crushing and dressing machinery without reference to the easy delivery of the material from the mine and the fall required for the perfect treatment of the ores, and for getting rid of the tailings.

Seventh—The almost universal want of any appliances for saving pyrites and fine gold.

Professor Hind supplements these causes with a few more, as follows:—

"Frequent incompetency of some of the so-called mine managers. Ignorance of managers regarding the pay-streaks; and neglect to preserve records and plans of work done, which are absolutely neeessary for acquiuring a knowledge of the ore shoots."

The greatest production of any year was in 1898 when 31,104 oz. 17 dwt, were produced. Since 1898 the production has been steadily decreasing and in 1915 it was 7215 oz. 1 dwt, 20 grs. This was the largest production since 1911.

Professor Stanley N. Graham of the Nova Scotia Technical College says in a report on the gold mines of Nova Scotia to the Department of Mines, Halifax, September 1915:—

"Mining can be conducted as cheaply in Nova Scotia as in any part of the world. This is particularly the case when the width of the slate belt is favorable and modern methods of overhand stoping and stope filling, saving timber and handling waste rock, are followed. Generally, the small veins will mean small mines and much development work will be required. In many cases, mills have been built too large and too much money spent on the surface. The mines are then hard pushed to keep up with the capacity of the mill and development work is apt to be neglected, with the result that the mines run out of ore. This evil is accentuated where, as is generally the ease, the pay-ore occurs in shoots. Under such eonditions the mine passes from a stage of ae-

tivity to that of waiting further development.

"I wish to emphasize the importance of proper mine surveys and maps. When mining in the neighborhood of old workings filled with water, safety demands that maps be kept and be frequently brought up to date. They are also a great aid in studying the shape and probable position of ore-shoots. This is a feature of great importance in our auriferous veins. By their use, development work could be intelligently planned and I believe the sinking of so many shafts—always costly work—as are seen on very many properties, could have been avoided."

Professor Stanley is possibly correct in stating that gold mining can be as cheaply conducted in Nova Scotia as in any other part of the world, if the mere extraction of quartz from the mine is meant. But cheap mining of the quartz is probably not the essential point. The real point is—Can gold be as profitably produced? If to land quartz at a crusher costs, say, two dollars at one point, and the result of the crushing shows a yield of an ounce to the ton; and at another point costs only seventy-five cents a ton at the crusher, and gives a yield of ten dwts. only, it would certainly be incorrect to say that the gold in the second instance was produced as cheaply as in the first. The profit in the one case would be about double the profit in the other.

Professor Stanley is no doubt on solid ground in stating that on occasions, far too much money is spent on the surface. Large surface expenditure, prior to anything like the necessary underground exploitation, may be said to be almost a habit with mineral exploiters generally in Nova Scotia. In several instances large sums have been expended on surface plant at our coal mines before definite steps had been taken to ascertain the "lay of the land" underground, and if the coal was of the quality and in the quantity desirable. A large sum was spent on the erection, on the surface, of a large plant for the distillation of oil from shales at a point in Cape Breton County. After the plant had been in oper-

ation a short time the promoters realized that it had been far better the shale had been exposed before the plant was erected; that is, unless the whole project was none other than stock jobbing trickery.

The gold mining men of the province have always been critical of the action, or rather inaction, of the government in relation to the gold industry. Perhaps the criticism has not at all times been deserved. On some occasions, at least, the government has acted on their suggestions. When the gold miners were the dominant factor in the Nova Scotia Mining Society, they asked that assistance be given to deep gold mining. The reply of the government was "We'll go halves." The gold men presumably wished the government to undertake the first—or the upper or easier half—without any guarantee—again presumably—from the gold miners that they would see to the second the deeper part, and so the suggestion came to nought. They asked that the government secure the services of an expert, or rather an authority of continental repute, to look over and report on the gold lands of the whole of the province. Such an authority was brought in and a report forthcoming. This report was far from acceptable to the gold miners, who asserted that no man, however much of an authority he might be, could furnish a full and satisfactory report, by simply traversing the province by a hop, step and jump, in quicker time than an airship could make the journey. A leading provincial gold miner was authorized, by the society, to frame a counter report, but before he had time to finish the work he was called hence. The gold miners, no doubt, will endorse what Professor Stanley says, in reference to proper mine surveys, maps, etc. These are among the things they have long implored the government to do and provide. Years ago, they petitioned the government for certain, alleged, needed reforms. The petition was a novelty in its way. Ordinary petitions first refer to the goodness and the graces of the one petitioned. It opened by a recital of the

mis-doings and negligence of the government, and laid bare its short-comings and its indifference to the progress and prosperity of the mining industries. Among other failings pointed out the petitioners declared:—That the Department of Mines has not been provided with sufficient means to keep maps of the mine workings, or to collect the facts necessary to a proper knowledge of the mines; or of the real values of mining properties to the province on the one part and to the lessees on the other:

That there has been no supervision over the gold crushers:

That there has been loss of revenue through lack of supervision:

That the mines have been preyed upon by stock jobbers:

That an agent be appointed, and that, besides the duties of inspecting and supervising the safety of the mines, he could be employed in—

First—Directing surveys of mineral properties and mine workings:

Second—Mapping ore bodies and estimating their probable value.

Third—Demonstrating various modes of mining and milling.

Fourth—Supervising crushers and smelters.

Fifth—Compiling proper maps and descriptions.

Sixth Directing schools for instruction of miners—gold.

Seventh—Collecting exhibits of ore, etc.

Judged by the knowledge presently possessed of the value and extent of the province's iron, copper, lead, zinc, and many other minerals that are lying around, the petition must have met the fate accorded a vast majority of the petitions presented to the government. It was pigeon-holed, without the tolling of the bell. Some of the suggestions were worthy of a better fate.

There are, on the other hand, those who are little concerned about maps and surveys and who censure the government for failure to encourage pros-

pecting, and in allowing speculators to hold areas for an indefinite period, without compulsion to either work the areas or forego their leases. It is even declared that unsympathetic legislation has driven prospectors, who did excellent work years ago, from the province. These criticisms cannot be called reasonable. The truth is that prospecting today is not the pleasurable, stimulating or profitable pursuit it was in the sixties, and for years following. The gold lands of the province have been fairly well scoured, and prospects having specks of gold in the quartz, readily discernible to the unaided eye, have been largely worked out. Just as in California and the Yukon in the early days gold was "struck" with but little effort, and therefore had attraction for the prospector, who as a rule worked and searched so long as there was a reward in the so doing, and no longer. So in Nova Scotia the prospector was with us so long as there was profit as well as pleasure in the profession, or so long as he was buoyed up with the hope that he would soon have his reward in a "lucky strike." Gold mining gold prospecting in the province has lost its speculative features and the charm of novelty, and it is now admitted that to be successful, gold mining must be made a real business, demanding intelligence, persistency and some little knowledge of science.

It has been said that it was fortunate for gold mining in Nova Scotia that the pioneers in gold production "struck it rich" that is, discovered quartz yielding high returns. Had the quartz crushed in 1862 to 1865 inclusive, yielded as small returns as the crushings of fifty years later, the pioneers in the business might have become discouraged. The gold yield in 1862 and 1865 was larger than in any year succeeding, with the exception of the year 1882, which gave the best yield of any in the history of gold mining in the province. The yield per ton of quartz crushed was in 1862 and 1865 a little over an ounce and two pennyweights and the yield

in 1882 a little over an ounce and three dwts. The following short table shows how in the later years the yield per ton of crushed quartz has gradually declined—(odd figures are omitted.)

Year	Quartz Crushed	Yield	per ton crushed
1862-1865	69,000 tons	67,000 oz.	19 dwts.
1866-1875	223,000 tons	150,000 oz.	13 dwts
1876-1885	158,000 tons	147,000 oz.	18½ dwts.
1886-1895	363,000 tons	213,000 oz.	11¾ dwts.
1896-1905	906,000 tons	256,000 oz.	5½ dwts.
1906-1916	379,000 tons	90,000 oz.	4¾ dwts.

In the early days prospectors turned their backs on quartz that yielded less than a full ounce to the ton. As stated, gold mining is not today a matter of lucky strikes. It is now realized that leads yielding from one to three ounces to the ton, as in the early days, are a very uncertain quantity. Instead, it is recognized that with proper skill and improved appliances leads which were formerly counted as of negligible value may be turned into, made sources of profit. In the Shebrooke district, in the early years, the average yield of gold was fully ten ounces to the ton crushed. Twenty years later the yield had declined to less than a half ounce. If all the gold mines in operation in 1867 be taken, it is found that the average yield of gold per ton is 17 dwts, whereas in 1897 it was only about 7 dwts. There were, say, 32,000 tons of quartz crushed in 1867 yielding 27,000 ounces of gold; in 1897, 76,500 tons were crushed giving a yield of only 26,500. The Stormont district, for some time the largest producer, gave in 1867 as stated, a yield of over ten ounces to the ton, and in 1897 gave a yield of less than five dwts. And yet that was no great cause for discouragement, rather for satisfaction, for it is declared that the profit in 1897 equalled that of 1867.

Two or three years ago it was expected that there would be a revival in gold mining. That this has not come about is due, in large measure, to the war. Labor is scarce and wages are high, and the cost of materials has greatly increased. At the same time,

gold is of much less value than it was ten years ago. An ounce of gold a few years ago was good for the purchase of eighty pounds of say, butter. Today you could not procure half that quantity with it, and what applies to this one article applies to nearly every article of consumption.

It is perhaps, then, after all not an occasion for wonder or surprise , that 1917 shows the smallest production since the industry had a footing in the province. And again, there is another reason besides these for the diminished production. Many gold miners, prominent in the business prior to 1915, have betaken themselves to new fields. They are busy prospecting and exploring, but not for gold. The war has created an extraordinary demand for many minerals, now necessary to its most efficient prosecution. The gold men are busy searching for these minerals. Some have made discoveries and possibly more than one has struck a "gold mine" metaphorically speaking not by exploiting or discovery, but by a sale of his lease. After the war it is expected these shall return to their native element.

Much more can be said on the subject. Those who would follow it further are recommended to procure a copy of Mr. Prest's admirable and exhaustive treatise on the "Gold Fields of Nova Scotia." It was intended to give an extract from the work, but the subject has been dealt with as fully as possibly desirable in a work having many subjects. A further reference however before leaving the subject.

The big or "lucky" finds of gold were not all in the early days or in the first twenty or thirty years of the industry. Possibly the richest find was that in the "Libby" Mine at North Brookfield in, or about, May 1899. In reply to an interviewer the owner of the mine said he could best give an idea of the richness of the find by showing a sample of the quartz. The sample weighed say a pound and contained about three-quarters of a pound of gold. This quartz was found at the bottom of the shaft which had reached a depth of 500 feet. At the time the

"find" was held to be an excellent argument in favor of deep mining. The gold was not found in ordinary quartz as there was not a sign of rock in the sample. The gold ran through a layer of iron stone. At the time of the discovery it was not known how much of iron stone there was similar to the samples, but the owner told the interviewer that he would be quite satisfied with a ton. The records are silent as to whether or not he got the desired satisfaction.

It may be that there has been a somewhat inflated importance attached to the mining of gold in the province. For several years regret has been expressed in the "Speech from the Throne" on the opening of the local legislature, at the decline in gold mining. Indeed from the reference to gold in the speeches a stranger might be induced to conclude that the mining of gold was one of the main commercial and industrial arteries of the province. It cannot however, truly, be said that the decline in gold mining affects to any appreciable extent the industrial situation. The loss of revenue to the government from diminished royalty is possibly the most keenly appreciated, and yet, after all, what does it amount to? It affords small occasion for wailing, and this should be apparent when it is stated that in 1917 the royalty amounted to less than a thousand dollars, and never in the best years of the industry exceeded $12,000, while a single colliery, one with what is a very moderate output, yields as much in royalty yearly as all the gold mines combined did in 1917. Then as to employment of labor. Three of the large coal companies gave employment to fifty-three times as many men as did the eight reporting gold districts. Five of the smaller collieries in 1917 employed more men than the eight gold districts, and be it noted, this is exclusive of the large number of men employed in the transportation of the coal by land and sea. The product of the gold mines in operation in 1917 could be carried to market in a couple of Gladstone bags, whereas to carry the coal to market some four thousand coal

trains and 630 steamers of a carrying capacity of 3000 tons each, with their crews, were necessary to transport the coal, and also exclusive of the many hands necessary to the unloading and carting of it away.

To gold, however, belongs the great credit of being one of the best of colonizers. The discovery of gold in Australia, California and New Zealand, in the middle of last century, led to mad rushes for these countries. Later there was emigration from European countries to South Africa and in recent years to Alaska and the Yukon. In a majority of instances the gold seekers after a time had to find other employment and ultimately made permanent homes in the countries to which the lure of gold had drawn them. In the case of the discovery of the precious metal in Nova Scotia it cannot be said that any rush of immigrants followed.

Those who are inclined, too seriously, to regret the decline in gold mining in the province in recent years, may be comforted a little by remarks made early in 1918 by Lord Gladstone. Speaking of the industrial resources of South Africa he said—

"The gold industry would probably last for generations but supposing in the course of a generation or two it was to decline, he, for one, would look upon that with no apprehension, because the labor would gradually be diverted to industries which would be of even greater value to South Africa."

THE FOUR EPOCHS IN THE INDUSTRIAL EXPANSION OF THE PROVINCE.

Were one expected to confine his survey to mineral production in the province only, he might be forced to say of the chief mining industry that three events occurred, which were chief factors in its progress. These three events, in the order of time, though mayhap not in the order of importance, were:

1st. The acquirement by London Capitalists—later to form themselves into a corporation known, for about three quarters of a century, as the General Mining Association—of the royalty bearing, or in other words, of all the then known more important minerals of the province;

2nd. The breaking up of the monopoly, some thirty years afterwards, and the securing to the province of all the minerals not reserved; and

3rd. The advent of the Whitney Syndicate, or Dominion Coal Company, Limited, in 1893 by which, without important exception, all the coal mines in the Southern portion of Cape Breton County, came under one control

A short reference will be made to the first of these events. The second and third will be included in Chapters under the heading, "The Four Outstanding Epochs in the Industrial Expansion of the Province," which in order of time are:

1st. The breaking up of the G. M. A. monopoly;

2nd. The advent of the Dominion Coal;

3rd. The securing of the Wabana ores of the

Nova Scotia Steel and Coal Company, Ltd. ;

4th. The establishment of Steel Works at Sydney and Sydney Mines.

It turned out a rather fortunate affair for Nova Scotia, that the Duke of York, brother of George IV, had a weakness for jewelry, and a fondness for luxurious living While a lad his tutors evidently had not inculcated the real pleasures of the simple life. The duke's tastes were of the expensive order, and in comparison his purse was slender. The consequence was that he plunged into debt to—among many others—his jewelers Though he was the King's brother, the jewelers did not consider his patronage as fully sufficient to offset the value of the jewels, so they—as plebians at times will—kept dunning his Highness for the debt. Getting tired of their importunity, he applied to his brother for help. This was given readily, the more ungrudgingly because the donation had cost him nothing in the first place. The gift took the shape of a grant of all the minerals in Nova Scotia to the Duke. He, after consideration, came to the conclusion that he was not eligible for commercial pursuits, and so transferred his grant to his jewelers. The bill he had run up with his jewelers must have been of formidible proportions, or else small value was at that time attached to the minerals, which are now considered of immense value to Nova Scotia. The Duke, of course, did very wrong in going so deeply into debt, and yet the province is ready to condone his folly, in view of the excellent results which followed the trading off of his debts due to his goldsmiths, for his unwrought copper mines in Nova Scotia, for it was copper, so it is declared, the jewelers looked upon as the principal asset in the grant,

THE FOUR EPOCHS.

EPOCH NO. I.

THE BREAKING OF THE G. M. A. MONOPOLY.

In order to a clearer understanding of what follows a few well-known historical facts may here be recounted:—

In 1826 the crown granted to Frederick, Duke of York, all the mines of Nova Scotia for 60 years "save and except such mines as are now granted under lease from the King, or any governor of Nova Scotia which have been opened or are in course of working." At that time two mines were working, one on the east and the other on the west of the East River of Pictou County.

The Duke immediately sub-leased the mines to the General Mining Association.

In 1828 the General Mining Association obtained a lease of the "reserved" mines in Pictou, and also in Cape Breton, at a fixed rental of £3,000 per year for which they were permitted to raise 20,000 chaldrons of coal Newcastle measure and also to pay 2 shillings currency on every chaldron over that quantity. The agreement between the Crown and the Association was thus made to absorb the lease of 1826.

In 1834 the Government of Nova Scotia claimed from the G. M. A. £1242-5-0 being a shilling sterling on 19,520 chaldrons mined at Pictou under the plea that the Association carried the work beyond the limits of the reserved mine and there had obtained the quantity of coal under the lease to the Duke consequently subject to the royalty. The claim was refused and was admitted afterwards to have

been preferred through misconception of the covenants in the lease of 1828 to the Association.

A condition of the lease to the G. M. A. was that if any unwrought area was applied for the Association must work that area or sub-lease it to any applicant and make answer in twelve months.

The first petition to the legislature under this provision was made in 1838 by Alexander Fraser of New Glasgow. Fraser first made application to the agent of the G. M. A. and subsequently to the Lieut. Governor for permission to raise and sell coals from a seam on his lands. His plea was that the area was unworked and that the price of coal had risen from 13|6 at the pit mouth to 17|-. A committee of the House of Assembly was appointed to inquire into the matter. This committee in their report declare—and the opening sentence is notable:—

"That it would have been sound policy in the government in the original settlement of the provinces to limit reservations to the precious metals, leaving other cres and fossils to be wrought at the will of the proprietors of the soil, 'this committee has no doubt." A statement to which not many would give the stamp of approval at this time. For the following reasons the committee could not see their way to grant the prayer of the petitioner.

"It was claimed by Fraser that Adam Carr had sold coal at 13|6 per chaldron and made a fair profit. Fraser is willing to pay 3|- per chaldron for permission to mine coals and thinks he can sell them for 12|-. This narrows the question to its operation upon the people of New Glasgow and its adjacencies. It is admitted by Mr. Brown (agent for the G. M. A.) that Fraser and all others who had coal on their lands would be benefited to—the extent of—their own consumption and a limited sale if there were no restrictions. Mr. Brown further admitted that Fraser could sell coal cheaply, that was mined above the water level, nor did he deny that Carr, whose pit extended only 54 feet from the surface, made money, but the seams worked by Carr were exhausted to the water level before he left them.

With every disposition therefore to assert the principle to which they have already referred and to afford relief in

all cases of actual hardship, the committee do not see in the evidence they have obtained, sufficient to call for the interference of the legislature. Mr. Fraser resides in New Glasgow, his work is to compete with the association in the supply of that town and its neighborhood by whose inhabitants his petition is chiefly signed. The whole quantity of coal supplied the town of New Glasgow within the past three years was, in 1836, 147 chaldrons round and 69 slack; in 1837 238 round and 74 slack, and in 1838, 279 chaldrons round and 104 slack, or a total of 664 chaldron round and 247 chaldron slack.

The committee refused the petition on the following grounds:—

"As it is admitted that the price in any but the New Glasgow market could not be affected even if the petitioners obtained what they seek, as it is clear from the returns that the saving to them, would be insignificant scarcely amounting to 6d per annum for each, and that this must cease the moment that Fraser's mine is worked to the water level; the committee do not think that, still saving and reserving the general principle already referred to, the hardships borne by the people of New Glasgow, or the advantages likely to arise from opening another mine are very great. Indeed in the case of nearly, if not all the petitioners the restrictions imposed by the association's monopoly would seem to be much more than compensated by the rise in the value of property, the demand for labor, and the consumption of every description of produce consequent upon the liberal expenditure of capital and the activity of a foreign trade in coals created by their enterprise and now fully established. "The following memorandum handed the committee by the agent of the G.M.A. shows the average number of men employed in or about the Albion Mines for the nine months ending Sept. 1838:—

Manager 1, Clerks 9, Coal Cutters 146, U. G. Laborers Pit Head men 20, Laborers 78, Loading Ground 50, Foundry 40, Brick makers 40, Capenters 30, Horse Drivers 33, Engineers etc. 18, Pack Carriers 6, Plasterers 5, B. Smiths 8, Sawyers 3, Farmers 2, Masons 2, Wharf men 4, Shipwrights 10, Crews of tugs 20, Saddler 1, Groom 1, Hostlers 3.

On South Pictou R. Road, Laborers and Horse drivers,

etc. 262, Masons 20, Blacksmiths 3 and Carpenters 11.

Horses on ground 49, do U. Ground 52, hired horses 102 total 203.

The quantity of coal raised by the former lessees in 10 years was 23,325 chaldrons, while in the 11 years ending 1838, the association produced 190,747 chaldrons. The capital of the association was £250,000. Up till 1838 £67,-000 interest on the investment was unpaid.

In their concluding paragraph the committee say:—

In view of these facts the committee conceive that the operations of the General Mining Association so far as they have traced them in the County of Pictou, have not only been highly advantageous to the province, by the introduction into it of much science and skill—the erection of eleven steam engines, the establishment of a foundry on an extensive scale where steam machinery may be repaired or manufactured, the creation of a foreign trade in coals, which during the last year employed 307 sail of shipping and may be indefinitely extended, and the annual expenditure in the midst of a population emplcyed in agriculture of upwards of £50,000, and to the Town of New Glasgow, which appears to have trebled in size during the past ten years, and to the persons who have signed the petition generally—

Would appear to have been a blessing and a benefit even admitting the charge which it contains of a rise in the price of coal.

This strong opinion the committee are bound to express; for while they conceive it the duty of the legislature jealously to watch over the rights of individuals, it ought in a new country to favor and encourage the introduction and employment of capital and the protection of those who are largely extending the trade and developing the resources of the province from unnecessary interruption or annoyance. To compel the General Mining Association to open Mr. Fraser's mine would be to put them to needless expense as their depot of coals is nearer than it would be to New Glasgow. That any great relief would be afforded if he was allowed to open it himself to persons who can purchase large coal at $1.75 and small at 65c. per chaldron, this committee can scarcely believe, and therefore

without in any way interfering with Mr. Fraser's rights to try in the courts the legal question which has arisen upon the construction given by the association to their lease, they can see no necessity at present for the interference of this house.

(Signed) JOSEPH HOWE, H. HUNTINGTON, Wm. YOUNG, E. M. D. F. T., H. BELL.

THE BEGINNING OF THE BATTLE.

From 1838 onward there was continuous contention between the local government and the General Mining Association as to the rights and powers of the latter. The House of Assembly, at various times, appointed committees to inquire into the question of the "coal mines." From a report of a committee consisting of George R. Young, H. Huntington and W. F. DesBarres the following summary is taken:—

"Your committee beg to state that in the consideration of this question several important views must press themselves upon the attention of the house.

First—That if the claims now asserted by the company be sustained the whole coal fields and mineral wealth of the province must remain for forty years longer in the hands of monopolists.

Second—That the price of coal at Pictou, in place of being diminished by the extent of their operations, has actually been increased, and is sold at a price far exceeding that at which coals could be furnished if our resources were opened to competition, while there is no guarantee that the price may not yet further be increased.

Third—That a large portion of the inland western counties, where firewood is nearly exhausted, or at least has become a very scarce and costly article, is actually deprived of a supply of coal from accessible pits in their vicinity, because the company will neither open them themselves, nor permit others to do so.

Fourth—That the company is now pressing the Imperial Government for a reduction of their rent, when your committee are satisfied from the evidence put before them, that if these mines were under the control of the legislature, twice, if not three times, the annual rent or royalty could

be derived from them, while coals could be sold at a reduced price and an extensive export trade be conducted with the United States and neighboring colonies.

And fifth—That the company claiming to be the owner of the mines and minerals of Nova Scotia (except in the few rare cases where grants were made not reserving these resources for the benefit of the Crown) they can for a period of forty years, regulate, hasten or impede the introduction of machinery and manufactures upon any extensive scale, and that the capital, enterprise and industry of the province must, for that long period, submit, to the control of a company, nearly all of whom are non resident, and who could scarcely be reached by the action of the legislature."

The committee after giving in much detail the grounds on which they had come to a conclusion submitted three different courses which the house might pursue. These conditions are:—

First—If the Mining Company are of opinion that the larger payment of the rent and royalty is too serious a burthen on their speculation, and that they cannot prosecute it successfully, it is for the house to say how far it would be prudent for them to offer to pay the company a moderate sum for the purchase of their establishment and a release of all alleged claims—the outlay is said to have been equal to £300,000 sterling, but the stock of the company in the London market is not worth anything like the original cost—and if any settlement were thought of, in adjusting the sum to be paid, the house, of course, would have regard to the reduced value of the works and machinery as they now stand.

Second—Although the house may feel restrained by the determination expressed by the Crown, relative to the alleged claims of the company and by the language before employed, that this legislature would not seek to invalidate any contract binding on the honor of the Crown, present circumstances force your committee to suggest how far the exercise of the prerogative in giving a lease of all the mines and minerals in Nova Scotia, excepting those worked in Pictou, to His late Royal Highness the Duke of York and subsequently leasing the said reserved mines,

and the mines in Cape Breton to the assignees of the lease, thereby creating a close monopoly, can be vindicated—"Prerogative" says the constitution is held for the benefit of the people. "The power of the prorogative," says Lord John Russell, "is never denied—its exercise only is questioned." If these principles are authoritative, it is not beyond the function of the legislature to say that an exercise of the Royal Prerogative which passed the entire mineral wealth of the province. . . . into the hands of a company creating a strict monopoly, was not and never could be for the benefit of the people of Great Britain, or of the province, and therefore it can be said that the lease and agreement were improvidently made."

The third course open to the house, passing by the question of title for the present, is to assert in the most unequivocal but respectful language, that the company, from the facts and reasonings contained herein, can prefer no valid claim, either in law or in equity, to the reduction of the rent, or royalty, or to an extension of their term, and to urge the strong necessity that exists in having some stringent regulation established by which under the condition in the lease to the Duke of York, in case the company, after notice, refuse to open and work any mine, the same may be transferred to the control of the legislature, so as to give the people of this province the benefit of competition in bringing into profitable use, the extensive mineral and manufacturing resources which exist under the surface of our own soil. . . . 14th, March 1845.

THE BATTLE CONTINUES.

Three years later, in 1848, another committee was appointed with objects similar to that appointed in 1845. The house on recommendation of the committee passed a series of resolutions of which follows a brief outline:—

"Resolved that the house reiterates its opinion that the lease to the Duke of York was an improvident and unconstitutional exercise of the Royal Prerogative.

Resolved that this house, being satisfied from the most accurate information extant, is surprised at statements made by the G. M. A. that there are coal seams unworked on lands granted by the government in which the min-

erals were not worked and which could be worked without payment of rent or royalty. The house being satisfied that the large proportion of said grants lie on the southern and western coasts of the province where iron and coal in juxtaposition do not exist:—

Resolved that the clause in the lease to the Duke of York which provides that he may work or lease any mine, after notice to the company, which the company is not working, is of small importance to the province, as the powers of the company practically remain unrestrained.

Resolved that His Excellency the Lieut. Governor be respectfully requested to cause an enquiry to be made into the grants of land passed from 1749 to 1782 and the reservation of mines made therein so as to secure an authoritative statement of the position, extent and value thereof.

Resolved that the house do not concur in the represent ation lately made by Mr. Cunard "that the treasury made a most advantageous bargain with the General Mining Association for the province" The royalty paid by the former lessees being seven shillings and sixpence per chaldron at Sydney, and at Pictou three shillings and eleven pence, while the royalty now paid by the association of £3000 yields only a revenue of one shilling and fivepence half penny currency. . . . the royalty paid, for all coals mined in Sydney and Pictou over the fifty-two thousand chaldrons, is only one shilling currency per chaldron, may not be advantageous to the revenues of the province.

Resolved that it was proved before a committee in the house in 1844 that when the assignment of the said lease was obtained in 1828 by the G. M. A. a capitalist in Halifax offered to accept a lease of the Sydney Mines alone at an annual rent of seven thousand pounds currency whereas the whole royalty paid by the G. M. A. was in 1841 £6184, 1842 £5487, 1843 £3473, 1846 £5475, 1847 £6132. . . .

Resolved after due care that your committee has estimated that had the G. M. A. paid last year (1847) for the coal raised by them such royalties would have yielded the sum of £33,343 instead of £6142.

Resolved that the price of coal has been raised at Pictou from thirteen shillings and sixpence to sixteen and sixpence per chaldron.

Resolved that this house are satisfied that if the unopened coal mines in this province now held by the G. M. A. and which as this house believes they have no intention to open, were under the control of the legislature, and open to fair competition, the price of coals in certain localities would be reduced and sold from eight shillings to ten shillings currency per chaldron.

Resolved that it has been satisfactorily proved to this house that vessels engaged in the coal trade belonging to this province and to the United States, loading coals at Pictou, have been delayed, last season, from the impossibility of supplying the increasing demand. . . . twenty-nine in place of four days in procuring a cargo. . .

Resolved that since 1843 every negotiation on this question with the Imperial Government has terminated unfavorably to the rights and interests of the people.

Resolved therefore that this house confiding in Her Majesty's desire to protect the interests and rights of Her Majesty's loyal subjects in Nova Scotia pray that effective measures may be taken by the Imperial Government to obtain for this legislature the possession and control of the unopened mines and minerals situate in Nova Scotia proper and Sydney, Cape Breton.

Resolved lastly that this house are satisfied that the people of this province never will be, as they never ought to be, content, until this question is satisfactorily settled."

Much correspondence passed in the year 1857 and immediately preceding. To enter into details would be wearisome. The G. M. A. and the Duke of York's representative came to a provisional agreement whereby the rights of the latter were relinquished to the former for a consideration. The agreement however had to be ratified by the House of Assembly. The agreement would release the Crown from all liability to the Duke of York's representatives, leaving the Association and the G. M. A. to settle matters as effecting them. Downing Street advised the province to send two gentlemen to represent the province and come to some understanding. Subsequently the association surrendered their rights to all the mines with the exception of four tracts of four miles each, two of these in Cape Breton and one each in Pictou and Springhill. The

G. M. A. were released from payment of £3000 alleged to be due the province in royalty and got clear it is believed of other sums due the province on royalty on slack, obtained a reduction on the royalty and was granted a lease of the areas mentioned till 1886. The bargain was a good one for the province and yet the delegation who went to London were criticized for their generosity at the public's expense. The eminent "Joe" Howe didn't like the bargain. He twitted the attorney general in this fashion:— "I hope the attorney general when he has gone under the ground might not become petrified, because if he did the G. M. A. would claim him dead as they had owned him when alive."

THE BATTLE ENDS.

After 1856 the G. M. A. was in a similar position as all other companies, subject to the mining laws of the province.

To the Johnstone-Archibald administration must go the credit of having broken the monopoly which the General Mining Association had held for about thirty years.

As the resolutions already related and the assembly's reply to a request from the Secretary of State form the basis of the final settlement of the long drawn out dispute, it is well that some space be devoted to the reply which, slightly condensed, ran as follows:

We, your Majesty's faithful and loyal subjects, the Commons of Nova Scotia, maturely considered the despatches recently received from your Majesty's Ministers, together with the drafts of three instruments connected with the mines and minerals of the province and of a bill to give effect to these instruments which have been forwarded to us for our sanction and approval.

We are required by your Majesty's Secretary of State formally to recognize and by our own act, confirm a lease to be granted to the representatives of the Duke of York for a period to terminate on the 25th August 1886 of all and singular the mines of gold, silver, coal, iron, ironstone, limestone, slate rock, tin, copper, lead and all other mines, minerals and ores in the Province of Nova Scotia with the exception of such as previously to 1826 had passed from

the crown under grants in which reservations were not inserted."

The assembly's address goes on to assert that in no part of Her Majesty's dominions does there exist a more loyal attachment. The province had at all times when the exigencies of the empire required not hesitated to show in the most significant manner, their heartfelt sympathy with the parent empire, etc., and continues:—

"In no colony of your Majesty's dominions have the pride and manly spirit of the population been more deeply wounded by the exercise of the royal prerogative. The act of your Royal prodecessor in 1826 disposing of all that is valuable in the minerals of the province equal in extent to half of England and distinguished for many of the physical and geological features which have made England what she is justified by no necessity of state and sacrificing to individual interests the prosperity of a whole province has created in the minds of the people of Nova Scotia a sense of injury which nothing but their loyalty and generous attachment to your Majesty's person and Crown have prevented from ripening into feelings which none would deplore more sincerely than your Majesty's faithful commons of Nova Scotia who are now called upon to affix by our own deliberate act the seal to our provincial degradation. We are required to enact that the coal which warms our people, the gypsum, the quarrying and exportation of which gives employment to thousands of our population and to much of our tonnage, even the clay and the slate and the limestone which enter into every branch of industry and are essential to the comfort and almost to the existence of our people, in one word, everything but the bare soil on which we tread are to be handed over to the representatives of an individual, to be sublet by them to a company. We are to take steps to vest in this body the right to prosecute thousands of our people for acts in which they have been engaged all their lives, to say that every house they build, every quarry they open, every ship they load with the materials which lie in boundless profusion at their own doors, shall subject them to be prosecuted as trespassers or tried as criminals.

After disclaiming any thought that the General Mining

Association would use their powers harshly so as to destroy themselves ultimately the address declared "We wish the liberties and privilege of the people to be held by a tenure more dignified and more secure than the generosity of two English gentlemen," and proceeds:—

"For these reasons we cannot consent to pass the bill. . . We have always been willing to admit the benefits which this province has derived from the operations of the General Mining Association we have already. . . acceded to changes in our relations with the United States which have relieved from a tax of 30 per cent the only article which the company exports in the principal market to which it is exported. We are even willing to go further, to remit to the company one half of the royalty they pay on that part of the coal to which that royalty applies; to engage to impose on all other parties who may open coal mines a burthen equal to the royalty which the company will have to pay and we will engage that no export duty shall be levied on coal. But we ask as the condition for these concessions that they shall forego a claim which is of **no value to them** but of great injury to us, that they shall relieve us from the sense of injury involved in the monopoly they claim; and allow us whether we choose to exercise the power or not, at least the freedom to engage in any mining enterprise which we may consider to be for our now interests, or the interests of our people."

The address admits that acts were enacted seeming to sanction to some extent the claim of the General Mining Association but they refer to a despatch of Colonial Minister Earl Grey in which they were informed "that it would not be impossible to induce the association to come upon reasonable terms to a modification of their claims." The same assembly that passed the Civil List Act of 1849. . . passed in the same session and almost on the same day without a dissentient voice a series of resolutions in which they asserted. . . . that they considered the grant as an improvident and unconstitutional exercise of the royal prerogative. . .

Under the treasury minute of 1849 the royalty is payable on all coal that is raised over and above the 20,000 chaldrons to which the fixed rent applies. The documents we

are called upon to sanction contain the important exception of such coals as shall be used in working the mines and engines and in smelting the ores and minerals and manufacturing the same. The extent to which this exception will operate at present is very considerable, but would be greatly increased were the company to engage in the manufacture of iron or other smelting operations."

One other important feature in these documents is the alteration in the arrangement with the Duke of York's representatives.

"The mines of Pictou and Sydney have alone been wrought to any extent. These mines were reserved in the original lease to the Duke of York; his representatives had no interest in the proceeds of the reserved mines. The association claim them under the agreement of 1828, yet we learn by the documents now before us that they have agreed to pay to the representatives of the Duke of York on all coal raised in the province, as well from there as from any other mines 1/6 sterling equal to 1-10½ currency on every Newcastle chaldron, thus imposing a tax to be borne by the consumer to an extent nearly equal to the royalty paid to the province. Already a sum of £55,-416-10-2 sterling has accumulated from this source, and only awaits the execution of these iustruments to be transferred to the Duke of York's creditors."

It is impossible to contemplate this feature of the arrangement without feeling that so long as the association monopolizes the supply of coal our people have to pay on an article of necessary consumption a tax which it cannot be pretended they ought to bear, to which they were not even subject by the original arrangement made by the crown in 1828, and which is imposed upon them by a grant to which they were no party, to which they have given no assent, express or implied."

In refusing to complete the documents submitted to us, we do so from a sense of the duty we owe to the people we represent, but we earnestly hope that the offers we make may be accepted in the spirit in which they are made and that your Majesty will be graciously pleased to interpose your powerful influence to close this protracted and irritating controversy."

"In conclusion we beg to assure your Majesty that in our belief it is the true interest of the association to adopt our proposition. If they consent to do so, and bring their operations into harmony with the general feeling of the community they will be respected as benefactors, not dreaded or disliked as monopolists, and in the vast field for industrial operations on which they have entered they will be aided by the cordial goodwill and kind sympathies of our whole people."

A PETITION FROM DR. GESNER.

The following petition of Dr. Gesner who played no small part in the discovery of minerals in Nova Scotia had also a part in hastening a settlement.

To His Excellency, Colonel Sir J. Gaspard Le Marchand, Knight and Knight Commander of the Order of Sir Ferdinand and of Charles the Third of Spain, Lieutenant-Governor and Commander-in-Chief in and over His Majesty's Province of Nova Scotia and its dependencies, etc.

The memorial of Abraham Gesner for himself and for the Honourable N. A. Cochrane, Chas. McKenzie, John S. Bartlett, Eugene LeGal, Charles Pegle, H. Gesner, Jas. W. Johnstone, jr., and others for whom he is an authorized agent:

Humbly showeth

That as long ago as 1838 your memorialist had discovered and described certain coal mines in the County of Cumberland in Nova Scotia. Since that period your memorialist has been desirous to work one of those mines in co-operation with men of capital, but in consequence of the claim set up by the General Mining Association of London, he has been with others, prevented from opening any mines in the province whatever. In 1838 your memorialist presented a petition to the executive government of Nova Scotia praying for a lease to open and work certain mines in the County of Cumberland. He was then required to describe the exact site where he decided to commence mining operations notwithstanding those mines were unopened and could not therefore be described without incurring considerable expense.

Your memorialist did however, at much cost and inconven-

ience describe one exact site, and in 1839 he was officially informed that his application had been forwarded to His Majesty's Provincial Secretary of State for the Colonies. They were afterwards referred to the Lords Commissioners of the Treasury who obtained from the law officers of the Crown a legal decision upon the subject. The reply of the Lords Commissioners was that your memorialist, or any other single applicant must point out the particular situation of any mine he desires to work, so that the assignees of the Duke of York may know distinctly to what they are to direct their attention. From this it is evident that the second petition of your memoralist in which the site was pointed out did not fall into the hands of their Lordships.

While your memorialist was preparing to renew his application and to describe the locality a second time, he was informed that the association had resolved to work the mine themselves, and believing that they would do so he refrained from puursuing his claim further at that time.

The mines still remain unopened in 1844. Your memorialist petitioned the Legislature of the province to relieve from the monopoly of the association and open to competition such mines as they had not then opened and worked. He was again informed by the agent of the association that the coal deposits of Cumberland would then be efficiently mined, but although the subject has at different times excited much discussion comparatively nothing of a practical nature has been effected, and valuable mines in different parts of the province remain unoccupied.

That any one company can improve and properly open all those resources is quite impracticable.

Fourteen years have elapsed since your memorialist applied for a lease of the Joggins Mines. The royalty paid to the government on coal raised from that place in that period will at once show that they have not been worked in any degrec to the extent contemplated in the lease to His Royal Highness the Dukc of York; even now they are not efficiently worked but merely occupied to the exclusion of others, and the mining engineer has removed from the province.

The limited demand for the coal affords no excuse, for

in this case a small reduction in the high prices charged for it would soon open markets for its sale.

Coals are now imported into Nova Scotia from Great Britain at a lower price than those produced by the Mining Association from the mines of the province itself, where the mineral is abundant and quite adjacent to shipping ports. Notwithstanding the Joggins Mines are conveniently situated for the supply of New Brunswick, coals are also imported into that province in large quantities from England and Scotland and even from the United States.

It is evident therefore that the prices of Nova Scotia coal are held too high and there is no competition to moderate the charge fixed by the company, who, if they find the working of the Cumberland Mines unprofitable should not refuse to lease them to the operations of others. . .

Your memoralist does not seek to mine at any situation where the company have fairly expended their labor and capital, but he complains that the coal mines at the Joggins in the County of Cumberland, a lease of which he applied for fourteen years ago, have not been worked by the association in any degree corresponding with their extent and value, but merely occupied to the exclusion of himself.

From this embarassment your memoralist prays to be relieved, and to understand distinctly whether any other persons except the association can open and work mines, within the limits of the reservations made to the Crown in Nova Scotia.

Your memoralist now more especially prays that a lease may be granted to him, his principals and associates for a term of years subject to renewal of the unopened and unworked mines suitated at Springhill in the township of Maccan, in the County of Cumberland, known as the Springhill Coal Mine to extend two miles in such direction along the line of the outcrop following the strike of the coal bed, and two miles in breadth across the strike of the beds at right angles to that distance, embracing eight square miles.

The influence of the mining association has been exerted to compel all applicants for mines to give security for their effectual working, while they themselves have given

no such security. To remove any impediment that might arise on this ground, your memorialist for himself, his principals and associates, offer the mines themselves with all improvements to be held under forfeiture for the fulfilment of their engagements, or such other security as may be required.

They also will agree to pay the royalty and lay down the required railroads to open the coal deposits and to mine them upon an extensive scale, reasonable time being allowed them for the construction of their work.

Your memoralist begs leave, lastly, to state that he has been thirty years engaged in examining the geological and mineralogical deposits of these provinces and in that pursuit has expended much labor and money. He was the first to discover many of the valuable resources of the province, and also the first applicant to open mines in the County of Cumberland. On these grounds he feels himself justified in urging the priority of his claims and in soliciting a favorable consideration of this his memorial.

Respectfully submitted,
(Signed) ABRAHAM GESNER.

Halifax, N. S., January 14th, 1853.

In 1853-1854 a number of questions were submitted to the agents of the General Mining Association by a committee of the House of Assembly. Except in a case or two it is unnecessary to relate the questions, as these may be gathered from the answers. The answers contain information interesting to the historian and also present day miners.

1 & 2 Pictou coal weighs about 31 cwt. p. chaldron and Sydney coal about 28 to 30 cwt.

3 The Newcastle chaldron is double the Winchester chaldron.

4 Coals are sold at the Pictou and Sydney Mines by the Winchester chaldron.

5 The prices paid at the loading ground at the several mines are as follows:—

Sydney, large 18|- per chaldron 9|7½ per ton, slack 5|6 p. chaldron.

Pictou, large 15|6 per chaldron 8|2 per ton, slack 8|- per

chaldron.

Joggins, large 16|- per chaldron 8|4 per ton, slack 6|- per chaldron.

6 Price at pit mouth same as at loading ground.

9 The weight of a cubic yard of coal is Sydney 14 to 15 cwt., Pictou 15 to 16 cwt.

10 The price paid to miners for quarrying varies from 1|7 to 2|2 per yard, according to the position of the colliery which is equal to about 3|8 per chaldron. A good cutter can earn about 9|- a day at these prices.

11 The cost of coal, exclusive of all over head charges, was stated in the House of Assembly in 1839 to be 12|1¾.

12 At Pictou the proportion is one chaldron of slack to every six chaldrons of large, each chaldron of slack costing the association the same as a chaldron of large, while it sells for only half the price. At Sydney the proportion of slack is about one-third. The coal is first riddled in the pit by the miner, from which a loss of about 15% arises; it is again screened on the surface, producing a further loss of about 15%, making the proportion about thirty per cent. The association can only find sale for 2500 to 4000 chaldrons of slack, at the low price of 5|6 per chaldron, the remainder being a total loss. There are now at the Sydney Mines several hundred thousand chaldrons of this coal, perfectly valueless.

If it is contemplated in the House of Assembly to impose a duty in future on slack coal we trust from the explanations given that the house will see the injustice of such a tax; but if the legislature should decide otherwise, the royalty should only be in proportion to its relative value with large coal, which is worth 15|6 to 18|-, while the slack is worth only 5|6 to 8|-. It is not usual to pay royalty on slack coal in Great Britain.

13 Coal is supplied to open order and the vessels are loaded in turn.

14 The association never ship coal on their own account and consequently have no depots.

15 Freights from Pictou to Boston averaged from two and a half to four dollars per chaldron last year 1852.

16 Last year from 170,000 to 180,000 tons of shipping were employed in this trade; the number of vessels was

1788, viz: from Sydney 734 and from Pictou 1054; of these 626 vessels were employed in the trade from Pictou to the United States, of which only 95 were American bottoms. In former years more than half the coal was carried in American bottoms.

Coal raised and sold in 1853:—

Pictou—89,474 chaldrons, of which 76,044 exported to U. S. and 13,430 to neighboring colonies and for home consumption.

Sydney—54,156 chaldrons, of which 9262 went to U. S. and 44,894 chaldrons for home consumption and neighboring colonies.

17 The average tonnage of vessels is about 120 tons.

18 Vessels are loaded as quickly as possible, shipping about 750 chaldrons or 1150 tons per day. There has been no detention of any consequence except on the occasional arrival of a large fleet of vessels at once, which may have been detained at Canso or elsewhere by contrary winds.

19 The prices quoted last year in U. S. were $5.50 to $6.00 for Pictou and $5.00 to $5.50 for Sydney.

20 21 22 The following statement will show that the increase (exports) was very great after every reduction of the tariff (U. S.)

1829-1832	9750 chal.	6c. bus. = $2.16 p. chal.
1833-1836	32,835 chal.	20% Ad Valorem
1838-1841	45,600 Chal.	equal to about 75 cents per chaldron
1842-1845	46,866 chal.	$1.75 per ton or $2.60 p chal.
846-1849	106,363 chal.	30% Ad Valorem=$1.00 p. chal

23 The price of Pictou coal before 1846 was 16/6 per chaldron.

24 The price of Anthracite coal in New York and Boston markets last year was five and a half to six dollars per ton.

25 The price of bituminous coal last year (1852) in U. S. was seven to eight dollars per chaldron.

27 Only a small portion of Sydney coal goes to the U. S. where it is used for domestic purposes. The association had made every effort to introduce this coal into more general use in the United States. Pictou coal is used to a large extent in manufacturing iron and for gas purposes.

28 The largest discount ever made was 1|9 per chaldron to a purchaser taking over 1,000 chaldrons.

30 Of course it would be to the interest of the association to open other mines if the demand so increases that they could not supply if from their works now in operation, or in the event or fault or failure in the seams now worked. The association are now opening a mine at Lingan to obtain a coal better suited for gas purposes.

31 No individual could work mines properly for want of sufficient capital. Inferior coal might be obtained from pits sunk to a small depth below the surface, but beyond that the application of capital would be necessary to a large extent; all unscientific works would be most injurious to future operations. Works conducted properly, with a view of raising coal of good quality, would certainly labor under disadvantages, compared with the association unless prepared to make similar sacrifices. The association have expended an enormous sum of money, and have reaped no adequate return in consequence of the demand never having, as yet, been nearly equal to their ability to supply (1854.)

THE COMING OF DOMINION COAL.

EPOCH NO. 2.

Brown's famous history of Coal Mining in Cape Breton comes down to the year 1870. The details given by Mr. Brown of the operations of the "New Mines" serve in a general way to show the extent of their development up to the date mentioned.

The period embraced between 1870 and 1893 may be looked upon as posibly uninteresting history and it may be needless to go minutely into details of the operations of the many companies. Between 1858 and 1893 no fewer than thirty mines, large and small, had been opened and worked to a lesser or larger degree. In 1893 there were some eight companies only in operation. In some cases the operators were not possessed of capital sufficient to equip their mines after the fashion of their wealthier competitors; while some found it useless to attempt to force an entry into markets already abundantly supplied with Cape Breton Coal. It came to be all but a case of the survival of the fittest, that is a survival of the fellows with the longest purses. The Blockhouse dropped out of the race when the coal in its land area had become exhausted. The Sydney and Louisburg abandoned a number of its mines and confined operations to what went by the name of the "Reserve" mines. The General Mining Asso-

ciation withdrew from the Lingan district. In 1892 the coal trade of Cape Breton was practically in the hands of the following companies:—General Mining Association, Sydney & Louisburg Co., Gardiner Coal Co., International Coal Co., Glace Bay Coal Mining Co., Caledonia Mining Co., Low Point, Barrasois and Lingan and the Messrs. Archibald. It was understood in that year—1892—that most of the mines by dint of rigid economy in all departments were yielding a merely perceptible return to their operators. The exertions to secure fair returns had been handicapped for many years by the continued decline in the price of coal. The needed extensions to the underground and over ground workings, the increasing strain on the machinery, and the difficulty in securing regular and reasonable freight rates, all combined to make the outlook from the operators' viewpoint any but a hopeful, far less a cheery, one. This state of affairs in the Cape Breton coal field required no gift of foresight to lead the operators to the conclusion that a few years must witness a reduction in their number. This belief impressed them, forcing upon them the consideration of some plan of co-operation, amalgamation or consolidation, as a possible alleviation of their troubles and a preventive of increased troubles in the future. At this juncture the attention of Mr. H. M. Whitney of Boston was directed to the great possibilities of the Cape Breton coal field.

From a business point of view there were directly visible certain economies in lessened costs of management, agencies, stores and shipping and consolidation of control generally, which would permit of great saving of time during the shipping season and would put an end to the excessive prevailing competition which was responsible for the little, if any, profit being made. Gradually the scheme of consolidation took shape and after much negotiation a form of lease was agreed upon, by the Syndicate and the Provincial Government.

It was shown by the promoters of the Syndicate that the then existing form of lease was not acceptable to investors in the United States. The system then in vogue, and only changed some years ago was that the leases were granted for a term of twenty years, and then renewable for four further periods of like duration, the Government reserving power to re-arrange the royalty. After a great deal of negotiation, a ninety-nine years—sometimes referred to as a straight-lease was given the Syndicate, a condition being that the royalty would be twelve and a half cents instead of ten cents per ton sold, coupled with a further condition that a fixed yearly minimum gross royalty be payable. These were the two chief changes, the lease in other respects following in its general terms the ordinary form of government lease issued by the Mines Department. The Government drove a fairly good bargain, and time has vindicated the wisdom of the concessions, if they can be called such, granted.

The capital of the Syndicate was placed at $18,000,000 with $3,000,000 of bonded indebtedness. It acquired the following working coal mines:—Gowrie, Caledonia, Reserve, International, Old Bridgeport, Glace Bay, Gardiner and Victoria, besides a number of virgin areas. These all were included in the long term lease and covered about seventy-eight square miles. The amalgamation was given the name of Dominion Coal Co. The Company subsequently acquired the Blockhouse and some other areas and secured further rights from the government containing fifty square miles, more or less. These at the time were not included in the special lease and are held on the same terms as granted ordinary lessees. In 1893-1894 the Dominion Coal Co. held all the working mines in the Sydney Coal field outside of those held by the G. M. A., with possibly a minor exception or two. The company also became possessor of large tracts of land to round out its holdings. It was said that at that time negotia-

tions were "on" between the Dominion Coal Co., and the General Mining Association. If so, there were no results. In 1893 the Caledonia and Glace Bay mines shipped at Glace Bay, where an artificial harbour had been excavated by the latter company—the Caledonia Co., having abandoned its expensive harbour at Big Glace Bay. Caledonia paid a toll of 12 1-2 cents per ton to the Glace Bay Co. The International and Sydney and Louisburg had each a railway running parallel for a considerable distance. Each also had a shipping pier, the former about a mile north of the city and the latter on Sydney water front. The coal from the International, Old Bridgeport and the Gardiner was shipped over the International Railway and that from the Reserve and Emery Mines over the Sydney and Louisburg. The mine at Victoria or the Victoria Mine, had its own railway connecting with a pier at South Bar.

The proposal to give the Syndicate a long straight lease at a fixed royalty met with a decidedly mixed reception. The Fielding Government of course, as initiators, stoutly favored, while the opposition and a few liberals strenuously denounced the proposal. It may not be uninteresting to very many to refer at some length to the opinions expressed and predictions made as to the disasters that would surely follow were the legislation sought for enacted. People today must greatly wonder at the bitter and hostile reception given to the bill granting rights to a concern which surely resulted in incalculable benefit to the entire province. Some of the prophets of evil are still in the flesh and it would be interesting to read the recantations and witness the form these would take. Leaving out for the present the denunciations in the House of Assembly—some of the speakers actual believers possibly in the views they then expressed—let a predic tion or two be given which appeared in some of the leading newspapers. In 1894 the following appeared in the chief opposition paper:

"It may be in order for me to make one—a prediction—and it is this:—'That within five years the Dominion Coal Co., will have absorbed or will control, every Coal Company within the province of Nova Scotia; will have acquired the chief areas not already acquired or under bonds to them; will buy up or destroy every new organization or company which may have been started; will have forced every schooner hitherto engaged in the coal carrying trade out of business by impossible low rates of freight and by undue detention at the loading piers, they having to give place to the larger craft of barges and steamers; will have rendered extinct the numerous class of merchants, small traders and co-operative store companies now doing business at and around the mines, by compelling first the miners, then all others to purchase their goods at the Company's stores; will have reduced the miners and their families to a state of vassalage, as wholly dependent upon them for the food and the clothes they wear, as were the southern negroes under slavery, and that the small farmers of Cape Breton, Cumberland and other counties who have hitherto depended upon the mining population and the store man supplying them ,taking a large part of the farm produce at liberal prices, will find that their produce must be sold, not to the store men and co-operative societies, at the hitherto remunerative prices, but to the company's stores at a price dictated by them, and in competition with carloads and cargoes brought direct from the great centres of cheap production in the west."

After the lapse not of five, but nigh five times five years the prediction is wholly unfulfilled and not one of the dire calamities have come to pass, with the possible exception of that referring to the displacement of schooners by large cargo steamers, a change that can not only well be defended but successfully vindicated.

Had the opposition to the coming of the "big"

company been confined to the opponents—in the province—a number of them violent politicians, it would not have been, perhaps, surprising as politics in Canada at times carry men far afield, but it was sought to set the people in certain States across the line and in parts of Britain against the Company.

Statements akin to the following were sent through Reuters agency to Britain and other countries:—

"The Syndicate formed in Boston for the acquisition of the Eastern Canadian Coal Mines is of greater magnitude than at first supposed. The combination embraces practically all the mines in Nova Scotia, the only province with coal producing areas between the Atlantic seaboard and the Great Lakes. It is stated on authority that an arrangement has been effected between the new Syndicate and the Reading Coal interests in Pennsylvania for making a gigantic monopoly of coal in the whole of Eastern North America. The combination has been formed under Nova Scotia legislation and the Domiion Government is powerless to interfere. It is pointed out that the question is one of Imperial interest as the new arrangement places the coal product of the North Atlantic seaboard, including foreign supplies for naval and commercial purposes under the control of a foreign syndicate."

At the same time despatches such as the following were sent from Halifax to Ottawa:—

"In the event of a war between the United States and Great Britain it would be a great advantage to the Republic to have the entire action of the British North American squadron at the mercy of a Pittsburg or Boston syndicate."

The opposition took many forms. The coal dealers in the United States were called upon to lend a hand. Their part was to decry Nova Scotia coal in an effort to show that the syndicate had no intention of operating the mines in a legitimate way. The coal it was declared was liable to spon-

taneous combustion and could not be piled or stacked over seven feet high, and that it was so fine that there was not a lump in it the size of an egg. A Boston financier who was disappointed, presumably in not being consulted in the formation of the syndicate spent large sums of money in decrying it and sent a special embassy to visit several of the C. B. collieries and gather all possible information that might assist in proving that Cape Breton coal was a worthless article. The emissary acted whole heartedly as instructed. He reported to his employer that at one of the large collieries the product might well be termed "black mud" but not coal. This so-called "mud" has found a ready sale during the many years that have elapsed since attempt was made to give it a black eye.

Turning from what was said in the press and that which was spoken in the Legislature:—

Mr. Fielding in introducing the Bill, entitled "An Act for the further encouragement of Coal Mining" said among other things:

"This measure is looked forward to with great interest not only by the members of the House, but also by the people of the province and by the people generally throughout the Dominion; indeed it would not be too much to say that it had attracted much interest in the United States and that it was a question of Continental importance. We can all rejoice that the great mineral wealth of the province of which we have boasted so long has at last commanded widespread attention. We have for many years been accustomed to speak and hear of the mineral wealth of Nova Scotia. We have recognized the fact that in the treasures of the earth we possess one of the most potent factors in promoting the progress and prosperity of the country. Providence has granted us rich stores of gold, copper, iron, lead, antimony, manganese and gypsum. All these are important and valuable minerals of the province. The air of romance which surrounds the search for

gold will always create a large interest in gold mining. But without underrating the importance of the gold mining industry it is not too much to say that the more practical men of the country will be inclined to think that we have a greater source of wealth in the coarser minerals, one of which forms the subject of the present bill. * * * Down to 1827, when the G. M. A. acquired their rights there had been only about 150,000 tons of coal taken out. In 1830 the output of the year was 56,000; in 1870, 568,879; in 1880 it was 1,788,111 and in 1891, 1,849,945 tons. There are many, no doubt, who think that a fair measure of progress for the coal mines of Nova Scotia."

Mr. Fielding then proceeded, as had the member from Pictou three days previously in the Legislative Council to show that the rate of progress in Nova Scotia did not at all show up well when compared with the rapid progress made by a majority of the coal producing states of America. The debates on the Bill were many and long. Replying to adverse criticisms, Mr. Fielding, among other things and chiefly in reply to Mr. Cahan, leader of the Opposition said:—"I believe the people will support any Government party that brings in capital and skill for the development of our mines and I believe the people will not be particular whether that capital and skill comes from Great Britain or from any other part, provided only it comes. I am satisfied that the enterprise which we now propose, even if it is only to be regarded from the standpoint of the Dominion's coal supply, will increase the development of the coal trade of Nova Scotia to an extent that could not be accomplished by the old methods. * * * The proposed enterprise is a large one, well worthy the attention of the legislators and the public. If anybody can show that Mr. Whitney has got a very good bargain out of this undertaking we shall not regret it very much, for we want him to have a good bargain. I want the enterprise to be a

success, and we want the investors to reap the benefit of their enterprise. We want to be able to show Mr. Whitney and the gentlemen associated with him, that the Mineral wealth of Nova Scotia is a solid reality. I trust their success may be the means of bringing many other capitalists to assist in developing the mineral resources of the province. We have boasted much of the mineral wealth of Nova Scotia, and have proclaimed so frequently that all the province wanted was to have its great mineral resources advertised, that I trust our wishes in that respect will now be accomplished, and the resources of Nova Scotia will flourish to a much greater extent than ever before."

Replying to the premier, Mr. Cahan said:

"Mr. Whitney may be honest and those who are associated with him may be honest people, but having secured for nothing franchises which they can mortgage for six million and a half dollars, would it be surprising if they used the larger portion of it in operations outside the Island of Cape Breton? Is there a guarantee that they will spend any portion of the money in developing the Cape Breton Coal Mines? I do not think so. There is no guarantee that the Company will engage in steamboat operations, or carry a ton of coal up the St. Lawrence. The inducements to give a lease for ninety-nine years were that there was to be a large investment of capital and that the operations were to be conducted as in the past, and yet from beginning to end of this contract, while the Government gives everything, and the legislature is asked to give everything, there is no guarantee that the company will conduct larger operations, or that they will carry coal to distant ports, or that they will build railways on the Island of Cape Breton. Nor is there any guarantee that the company will take the lease, and having mortgaged their purchases, will not use the money for such special purposes as they may deem expedient. It may be in their interest to close up

the mines, or it may be to their interest to give a certain development. But you say there is a guarantee of $123,000, or if you take the interest on the bonds in addition there is a guarantee of $502,000 a year which the company must pay whether the mines are worked or not. But suppose they pool their interests with the Reading Co. Suppose they come to an understanding, as they are bound to do, if the tariff is taken down? By simply producing coal to supply the demand for home consumption in Nova Scotia, New Brunswick and Prince Edward Island, it will be quite possible for the Company controlling the market, and without competition, if they raise nine hundred thousand tons or a million tons of coal, by restricting their operations to this market, and by adding fifty cents a ton to the price to raise $500,000, sufficient to more than pay the interest on the bonds and possibly the royalty payable to the crown. By the simple expedient of raising the price to the consumer sixty cents, they can wipe off all their obligations and conduct their operations on a profitable basis. * * * If the people of the province fully realize the nature of the measure and its scope, binding generations yet unborn, they will rise in their indignation and demand that the monopoly shall be swept out of existence. We are face to face with conditions that portend the greatest possible evil to the province. Mr. Whitney and his present associates may act justly and may use their large powers legally, and may carry out, for a time, their promises, but what guarantee is there that the successors of Mr. Whitney will not use to the fullest extent the enormous privilege conferred upon them by this lease. Even when it was proposed years ago to make the duration of a lease 28 years, the proposition was denounced in the most glowing terms by the able statesmen of that day, who declared that it was improvident, unwise and vicious to legislate even a generation beyond their own by a contract such as this before the House,

which contained far greater safeguards than the one we are now discussing, which is irrevocable except by a great breach of faith on the part of the government and legislature. * * * No such franchise was ever conferred before by any British Legislative body."

In the speeches in the house there was perhaps of necessity much repetition as the Bill was discussed at a session called earlier than customary and which was adjourned after the Bill had been read and considered. Probably much information was contained in the remarks of Attorney General Longley and this is therefore warrant for giving an extract or two here:—

" * * * If therefore there were any possibility of disaster staring the province in the face by virtue of one person controlling a very large number of areas that condition has been staring us in the face for years and years, but it has never resulted in anything serious. All the horrors and fears of monopolies and combines could be anticipated with much greater reason by virtue of the condition of things which existed in Nova Scotia for the past 35 years than by virtue of the condition of affairs which will exist when the Whitney lease has gone into operation. The only step that any government thought of taking to limit or curtail any rights of lease holders with a view to prevent the closing of the mines is included in the measure now before the legislature of Nova Scotia. If today instead of opposing the lease the agitators would induce every person holding leases to give up their leases and accept leases containing similar terms to the one now submitted to the legislators then the coal industry of Nova Scotia would be a thousand times better protected than ever before in its history. Here are the points of difference between the Whitney and the ordinary forms of leases:—

First—Whitney leases contain a provision giving fixity of royalty during the full term of the lease.

Second—Under the old leases mines could be closed subject to a penalty of the payment of $30 each year per square mile. Probably that has been the condition since 1858. It is true that the condition of 'work' was previously the condition of continuing the lease but there was nothing in the lease to require any specific amount of work to be done. Now if any horrible machinations are invoked to close up the mines, what is the result? If the Springhill Mines close, if the mines of Cape Breton close, we have no control over it; whereas if Mr. Whitney closes the mines he has to pay $123,000 into the treasury. . . . . .

"* * * As to the charge of shutting up the mines, etc., if Mr. Whitney and his associates desired to do all these things it is said they will do the last thing they would do would be to come to this legislature—this Government—and ask for such a lease as this. If Mr. Whitney had any such deep, dark and diabolical project in view, would he ask us to change the lease and put in a clause which will compel him to pay $123,000 for ever during the existence of the lease? Not a bit of it. He would have come in under the old lease and have bought the mines of Pictou and Springhill and then have closed them entirely or worked them colorably as suited his purpose. The Government has imposed conditions which for the first time gives us a complete safeguard.

There is one other condition in the contract which differs from the lease the legislature has been giving for the last 3 years, and that is the provision that instead of receiving 7 1-2 cents per ton we are to take from Mr. Whitney the sum of twelve and a half cents per ton.

"If we could believe that the persons who go into the coal mining industry notwithstanding all this denunciation, are wholly lunatics, and would freely and readily invest millions without intending to receive some return by working the mines, furth-

er safeguards might be imposed, but there is nothing of magic about coal. There is no difference between coal mining and any other industry in the province and it would be possible today to a man who had money enough to go around Nova Scotia and buy every farm and persons might be alarmed that some speculator intended to close down every farm in Nova Scotia. There is nothing to prevent any person in Nova Scotia buying all the fishing boats and equipments and all the wharves without regard to putting them to profitable uses. Just consider for a moment the imaginary dangers. "Monopoly Combine." The closing down of our mines. Let it be understood that the coal mines would be a monopoly, but the worst monopoly would exist if some coal mine owner acquired all the mines of the province with a view to increase the price to such a degree as to make it oppressive to the people."

The opposition to the Dominion Coal Co., did not end with the passage of its act of Incorporation by the legislature, but continued of a somewhat violent nature for years. Five years after it had secured the control of the South Cape Breton Collieries, a leading newspaper, representing the views of one of the political parties called upon the electorate at a forthcoming municipal election to "vote only for those aspirants who publicly and without reserve pledge themselves to watch, oppose and destroy the combination referred to—the Dominion Coal Co.—which at the present time appears partly as a mighty incubus and partly as a gigantic nightmare casting a sullen gloom over the resourceful and promising Island of Cape Breton." Another leading paper termed it an "Octopus."

Every known epithet was applied to the Company, as for instance—"They were autocrats trampling upon the rights of the people; they were despoilers of business; like the horse leech their cry was ever give give; they carried the local government in the hollow of their hand, and led the prem-

ier of the province captive at will. If not brought up shortly and sharply they would certainly be the ruination of the country and force every able bodied native to the western provinces; and yet, notwithstanding all this denunciation a strange thing happened. Time passed, as time will, and with its passage caused a change; its bitterest opponents turned round and bestowed praises where they had formerly dealt out censure, they admitted cheerfully or grudgingly that:—

"The miners condition is changing.

That there is labour at the mines twelve months in the year where seven or eight only were worked previously.

"That the workers if they desired could find work 313 days in the year.

"That the prospects were for night as well as day shifts.

"That the credit system has greatly diminished

"The Company would place the stores on a cash paying basis or perhaps sell out altogether. This would have been utterly impossible in the past owing to the long period of idleness each year; the workmen were in a great measure dependent upon their employers during the Winter months. Instances can be given which go to prove that miners who were saving under the old rule are now saving more and many of those who aforetime saved nothing, are now laying by for that rainy day for which provision should be made by every class of wage earners. These facts and they are facts, show plainly that the position of the miners of Cape Breton is improving, and is one that any other class might envy"

A short answer to all the evil prophecies and the violent aspersions of the company may be summed up in a sentence: Coal Sales Nova Scotia, 1873—881,106; 1893—1,485,924; 1913—6,478,709 tons, or an increase for twenty years ending 1893 of 68·64 per cent. and of no less than 336 per cent for the twenty year period ending 1913.

THE PART WABANA PLAYS.

EPOCH NO. 2.

Had there been no Bell Island, to draw upon, there had been, in all probability, no Nova Scotia Steel, nor Dominion Steel Companies. The acquirement of the Wabana areas by the Nova Scotia Steel & Coal Company, was the step, next, if indeed it did not transcend in importance the formation of the Dominion Coal Company, which has played a great part in placing Nova Scotia in its present highly prosperous industrial position. There may be still left a few ready to question such an assertion, and declare that the acquisition of the Newfoundland iron deposits was not an unmixed blessing, and that, had these not fallen into the hands of the Nova Scotia Steel Company, there would have been a persistent, determined, and honest endeavour to discover and work the iron ores, which all authorities up till within twenty-five years ago, declared might be found in the Province in abundance. Honest attempts to secure native ores were, however, made previous to 1895 by the Nova Scotia Steel Company, and this company mined ore at the East River, and at Brookfield, until the deposits became exhausted, or of no commercial value. This company also tried to develop the ores at Arisaig, but the attempt proved unprofitable. The steel industry could not have attained its present prominence had not the foresight of the members of Nova Scotia's pioneer steel industry led them to secure the deposits at Wabana, deposits which

at the time of their purchase, were not considered to be a fraction of the value they have assumed, within recent years, as a result of exploitation and development. There are no deposits of so large extent, and containing so valuable ore, in any of the industrial countries in the world. There have been frequent attempts to estimate the tonnage of the ore in the deposits. That now has long been given up, as the work of exploitation has demonstrated that the extent of the deposits far exceeds that hoped for by the foresighted Nova Scotia Steel Company, who had the courage to secure the property at a time when it went a begging Fifteen years, or more ago, the deposits were looked upon as valuable, ten years ago as very valuable, and at the prerent time it may, not only figuratively, but literally, be said of them that they are of inestimable value. And their value is not increasing solely because exploitation has demonstrated that they are of greater extent than first dreamed of, but also from the fact that the best known deposits in other countries are undergoing gradual depletion. In recent years calculations have frequently been made as to the probable amount of ore in these deposits. Several years ago the writer ventured to make a rough calculation as to the ore tonnage, and was content to place it at about a thousand million of tons This estimate was far too modest A calculation, based on exploration up to date, by three seperate competent authorities places the quantity at close on three billion tons, a quantity sufficient to last a century, the yearly output calculated at thirty million tons.

It has been stated that the portion of the deposit sold by the Nova Scotia Steel & Coal Company to the Dominion Steel Corporation contained the best of the ore. This is scarcely the fact. All the ore on the Island is good, and Scotia' retains much of the best, and by far the largest in quantity. It is a matter of record that on the land areas there are three square miles, this mileage being held in fee simple from the Newfoundland government. Of these three square miles 'Scotia' owns the Scotia and the little upper beds and the Dominion Steel Corporation the lower or

'Dominion' beds. In submarine holdings the 'Scotia' company own, in fee simple from the crown, 83 square miles, and the 'Dominion' five and a half square miles, three of these being immediately adjoining on the land, and two and a half square miles in a belt beyond the 'Scotia's' submarine areas. Regarding possible tonnage the Dominion have remaining probably twelve million tons. On their submarine areas the quantity within safe working cover may be put down at sixty-five to seventy-five million tons. The Dominion Steel Corporation own also a block of two and a half square miles beyond the 'Scotia' submarine areas. Assuming that this is of the same thickness as the ore in the 'Scotia' submarine area now being worked, the corporation would have about seventy million additional or a total of approximately one hundred and fifty million, a tenth part or so being on the land areas. The upper bed, on the land, is, say, eight feet thick; the lower bed, from nine to fifteen feet. The lower bed has increased in thickness as development work was prosecuted, and in the new 'Scotia' workings varies from sixteen to thirty feet in thickness. This is clear ore, without a pebble or streak of rock of any kind. Some of this ore runs practically as high as 587. of iron.

The foregoing may not be very pleasant reading to the provincial iron ore optimists. They may be ready to declare: "Here we have the reason why provincial ores have not been sought after and explored." That is not a generous declaration in view of the fact that the two big steel companies have spent much time and large sums of money in an effort to discover iron ores in the province of economic value. The Dominion Steel Corporation have had options on, and prospected, alleged rich iron ore areas in Cape Breton, Inverness and other counties, and have failed in their search. The 'Scotia' company have paid smartly for their efforts to secure ores in the province in quantity and of economic value. Mr. R. E. Chambers had a favorable opinion of the iron ore at Brookfield. He had shipped about three thousand tons to the Londonderry Iron Works, when the Nova Scotia company took over the property, and shipped about sixty thous-

and tons to the plant at Feronna, which was smelted there. From Torbrook the company took about one hundred thousand tons, and from Arisaig three thousand tons. From the East River about three hundred thousand tons were secured. Some of the ore from Arisaig was lying around when the Feronna furnace was dismantled. It was too high in sillica aud too refractory to make it of practical value. The company had used about three hundred and fifty thousand tons of provincial ore when it was found impossible to get further supply in the province, and therefore were forced to the importation of the Wabana ores. Indeed, the last two or three years the furnace was in operation it was fed entirely with these ores, home sources having failed.

Bell Island is reached by a twelve mile drive, from St. John to Portugal Cove, lying opposite the southern shore of the Island. The Island is reached by boat or steamer. As one nears the Island it looks an unbroken precipice to the sea, except at one or two points. The Island is six miles long by two miles wide. It is, at times, referred to as the Island of Iron. When iron was first known to exist on the Island is conjectural. It is claimed that the first practical use to which the ore was applied was the making of an anchor for a fishing boat from a lump of it The Nova Scotia Steel & Coal Company were the first to begin the extraction of ore at Belle Isle. By the way, the Island is prefixed at times by Belle and at other times by Bell. Its setting may be beautiful but the Island itself can scarcely lay claim to beauty, apart from that attending boldness and ruggedness. The Island is named after a rock on the west end which is bell shaped.

Iron was known to exist in the Island many years before the deposits were taken hold of by the Nova Scotia Steel & Coal Company, who came into possession of the deposits, after the following fashion :

Along in the summer of 1893, a young man named Butler, of Topsail, Conception Bay, Newfoundland, was employed on the West End Street Railway, of Boston, where work was carried on by the late Dr.

Pearson, who later became associated with Hon. B. F. Pearson, and Mr. John White, of Halifax, in the acquisition of the Halifax Street Railway. Young Butler had some conversation with Dr. Pearson in regard to iron ore at Conception Bay, who, in turn, discussed the matter with Hon. B. F. Pearson.

The latter asked Graham Fraser if he would allow R. E. Chambers, the Mining Engineer of his company, to go down and examine the property, and report in regard to it. Graham Fraser consented and Mr. Chambers was sent down. He duly examined the property and made a report to Hon. B. F. Pearson. Mr. Pearson, or White, or both of them, then took out an option which fell due on August 4th , of the following year, on which day payment of $4,000 was due. This payment was not made, with the result that the option expired, and the then owners, the firm of Sherring and Pippy, were free to negotiate with other parties. Later they gave an option on the property to the New Glasgow Iron, Coal and Railway Company, then operating a furnace at Feronna.

After examination of the property by Graham Fraser, R. E. Chambers and Thomas Cantley, the property was acquired by the New Glasgow Coal, Iron and Railway Company on a royalty basis, with the option of purchase at a figure agreed upon. The New Glasgow Iron, Coal and Railway Company then proceeded to develop the property, constructed an endless road tramway, and built a pier on the south side of the Island, and on the pier was constructed a block of five pockets or bins for receiving the ore from the tramway cars into chutes, and which in turn was delivered into steamers moored alongside. The first steamer loaded with ore left Wabana on Christmas Day, 1895, and discharged the cargo at Halifax, Pictou Harbor being then frozen over.

As trade in shipments of ore increased, additions were made to the plant. A new pocket and bulk head have been installed, and two large ships the Themis and the Tellus, with a carrying capacity of 13,000 tons, have been each loaded in three and a quarter hours. The first exports of ore by the company were to the

United States. Shipments to Germany and Britain followed. Up till the end of 1917 close on seven million tons of ore had been shipped from the Port of Wabana This gives indication of the progress made in the development of the deposits. The idea of the company, at the start of operations, was to get a supply for its own uses, and therefore the first work done was in a tentative way The work was under the capable management of R. E. Chambers, one who says little, thinks much, and does wonders. Of Mr Chambers it has well been said that he is a Nova Scotian—and the name itself is an effective certificate—of push, resource, and practical experience, and this is emphasized by the fact that he still retains close supervision over the largely extended operations. As stated, it was not the original intention to produce ore on an extensive scale, and yet, plans were so well laid, that the plant was suited for a large output should the demand for ore in the future go beyond the first modest operations. Very soon after operations started at Wabana it was found that the company could dispose of much ore at paying prices to several countries, and there was a growing export trade until the war interferred.

It may be interesting to relate how the ore shipping port of the Nova Scotia Steel & Coal Company came to be called 'Wabana'. The unique privilege of putting a new name on the world's commercial map fell to Thomas Cantley, past president of the company. He suggested that the mine and the port, or, in short, the property, be given the name 'Wabana'. The Board of Directors readily fell in with the suggestion. The word is of Indian origin, the root word in the Micmac, 'Waban', the meaning of which literally is 'place where light begins'. And as Wabana is the farthest point East, and therefore, on this side, nearest the rising sun, the name is admitted to be most appropriate, and furnishes proof that the Micmacs were not an unpoetical people.

On a previous page it is stated that the purchase of the Wabana property was a step next, if it did not transcend in importance, the formation of the Dominion Coal Company. There are those willing to declare that at

the present time the steel industry has proven to be a greater factor in the industrial progress of the province than has coal. This is a debateable point, and need not be referred to at any great length. In a sense, it may be quite true, that during the past twenty years 'steel' has tended more to the prosperity of the province than coal, and it may also be admitted that in the years to come steel will play a much greater part, yet it must not be overlooked that the prosperity of the steel industry in the province rests on the province's ability to supply coal, for the smelting of the ores. Of steel and coal it may be said, in short terms, that the one is the corollary of the other. The Nova Scotia Steel & Coal Company is not a thing of yesterday. It has expanded step by step. Its genesis is found in the starting, in 1872, of the Hope Iron Works, with the modest capital of four thousand dollars, which has grown into a company whose capital is sixteen million dollars. There are many things to be credited to the intelligence and foresight of those who were associated with the beginnings of the enterprise, and those directing it, in later years. The late Graham Fraser was the pioneer of the industry, which now plays so important a part. It is claimed for 'Scotia', among other things, that it produced the first Siemens Martin, and the first basic steel, made in Canada; the first to establish a cogging mill, and roll an ingot into billets, the first in Canada, possibly on the continent, to wash coal, by a scientific method; to build and operate retort coke ovens; the first to make steel railway axles, etc. Further it may not be denied that its demonstration of the value of the ores of Wabana, and also, about the same period, proving that the despised culm coals of Cape Breton could be so washed as to remove the sulphur and produce coke suitable for blast furnaces, when treated in retort ovens, were steps which, above and before all, justifies the claim that 'Scotia' laid the foundation of the rapidly expanding steel industry of Eastern Canada. It is also to the credit of 'Scotia' that it has not been content with the introduction of improvements spasmodically. These are continuous, among the latest being the installing of steam-hydrau-

lic forging, and steel compression plants—the first of the kind to be operated in Canada.

One familiar with the history of 'Scotia' says :

"In the last analyses the strength or weakness of any company is due to the calibre of the men who manage its affairs, and 'Scotia' has always been exceedingly fortunate in the men who have served on its directorate". Referring to Thomas Cantley, who succeeded President Harris, on his elevation to the bench, and who is presently Chairman of the Board of Directors, the same writer says : "Mr. Thomas Cantley, second vice-President and General Manager, entered the service of the company in 1885, as Sales Agent, the capital then being less than $160,000. Four years later he became Assistant Manager. He was appointed Commercial Manager in 1900, and General Manager a year later. Thus he has been with the company in all the important stages of its growth, and its greatest progress has been attained since he assumed its management."

It will be necessary further to refer to the part played by 'Scotia' in the article dealing with the Dominion Steel Company under the heading of Epoch No 4.

Frequently has it been predicted that Nova Scoiia, in the not distant future, will be known as the 'workshop of the Dominion', and present indications are that it will be well entitled to that distinction. She has within her borders, or within easy access, all the requisites constituting the basis on which rests the development and permanence, of manufacturing and industrial pursuits. These are, of course, coal and iron. She is highly favored by her geographical position, which affords easy and economical access to all markets which can be reached by the Atlantic Ocean, which laves her shores, and under which her coal seams run, and the iron beds of Wabana, from which are drawn her ore supplies. The fluxes are abundant in the immediate vicinity of her iron furnaces, and so situated as to allow of mining costs being low, and transportation cheap. The general conditions all go to favor the manufacture of steel in unlimited quantities. Mr. D. H. McDougall, General Manager of the

Dominion Steel Corporation, in a paper read before the Canadian Institute, says :

"A review of the iron ore and coal deposits of Canada will show that such a combination is to be found in very few places in Canada, and that already large steel and iron works exist at the localities where the manufacture of iron and steel is permitted by natural conditions to rest upon a permanent and commercial foundation.

"The location of iron and steel plants in all parts of the world has been primarily determined by the proximity of coal, and it does not seem probable that any steel plant can exist and pay profits in normal times which has not to hand a plentiful and inexpensive supply of metallurgical coal It is perhaps hardly an exaggeration to say that the steel industry is always an outgrowth of a coal mining industry."

From a paper read by Mr. C. L. Cantley, before the same society, a few years ago, are taken the following, condensed, statements :

"In estimating the importance of the iron and steel industry to the province of Nova Scotia, the iron and steel produced, as has been shown, is manufactured largely by concerns that are also engaged in the mining of coal. For this reason a differentiation between the two industries to determine the relative importance and value of each to the community is somewhat difficult.

"An endeavour in this direction has been made, however, by the segration of capital invested and of expenditure in the following table :

CAPITAL INVESTED.

Total paid up capital of steel companies (approx.)	$ 88,000,000
Proportion of capital invested in steel industry	50,000,000
Proportion of capital invested in coal industry	38,000,000

Deducting the expenditures made in connection with the operation of the iron mines at Wabana, Newfoundland, the actual annual disbursements of the steel in-

dustries in the Province represent :

Wages	$ 6,350,000
Supplies	2,800,000
Freight to Canadian railways	1,250,000
	$10,400,000

The companies, moreover, employ over 26,000 men, of which number 10,000 are engaged in producing and manufacturing steel, 8,400 being employed in Nova Scotia, while 5,000 are directly engaged at the steel plants.

When it is remembered that each wage earner represents, on the average, a family of four members, it follows that over 30,000 persons in Nova Scotia are directly dependent for their means of livlihood on this industry ; or, including the associated industry of coal, in which case the number of men employed is increased to 26,000, over 100,000 persons resident in the province are dependent on the steel industry. In other words, if, for any cause, the two large companies discontinued operations, one out of every five persons living in the province would be deprived of his or her present means of livlihood".

The capital invested, has, of course, been largely increased since the paper, above referred to, was written, and in view of large additions to the plants now underway, will, no doubt, be much further largely increased.

The progress of the steel industry of the province is displayed by the production in past years. In 1901 there were produced some 26,000 tons. In 1912, two years preceding the war, the production had increased to 467,763 tons.

It may possibl be asked, and with some show of reason, why it comes that the tonnage of a property, first estimated to eontain two hundred million tons, has grown into a property containing twelve to fifteen times the quantity. The simple answer is that when the first estimate was made no one was bold enough positively to deelare that the ore ran for miles submarine. That was hoped for, but who would undertake boldly to say it did. The high tonnage

now placed upon the property is based on the exploratory work which has been done, and which has been a revelation. Engineer and ore expert Scott's report in 1899 was in effect that the property contained 400,000,000 tons. This report was made when the sinking of the first submarine slope was in progress, and before the company had reached the bottom of the present slope, and therefore at a time when he had not the data, to form the enlarged opinion, that exists at the present time. At that time the company held only thirty square miles of submarine areas, while the holdings at present are 82 square miles.

Scott felt unable to decide the definite limits of the area, covered by the ore basin, and referred first to Howley's estimate of it, as an elliptical basin five and a half miles in width and eleven miles long. He measured the face of the submarine slopes at the point to which they had then progressed and also took some evidence as to the result of bore holes drilled in advance of the actual slope face. The total thickness of the submarine area, as shown in the advance then reached, he put at 27 feet, or an average of 25 feet, and, while at that time the face of the slope was only about five hundred feet past the Dominion submarine eastward line, or 500 feet within the Scotia submarine deposit, he felt, in view of the regularity of the dip, and other factors to which he refers, he was justified in assuming a gross tonnage, divided into "mineral practically proved" 204,000,000 tons, and "minerals reasonably supposed to exist" 448,500,000 tons.

When the slopes were driven to the place where the driving of levels east and west began, the ore had increased in some places to as much as thirty feet, and indeed over that. Further the geological field work carried out by Messrs Eckel and Van Ingen threw a great deal of light on the structure and boundary of the ore field. The conclusions then arrived at were further corroborated by a large amount of deep water dredging, to the eastward of the is-

land, along the line of the eastern and northern outcrop, in the bottom of the bay. All these doings were within Mr. Eckel's knowledge when he made the report which formed the basis of the evidence given by him before the United States Supreme Court in the United States steel dissolution suit.

The value of the Wabana deposits as an asset of Scotia, is suffieient to astound one. Let the quantity of ore be taken at the moderate estimate of two and not three billion tons. This deposit sold to United States capitalists who appreciate its future value, or to capitalists across the water,—foreed to import ore,—at a cent a ton, would realize more than the entire capital stock of the company,—bonds, debentures, preferred, and common stock, and leave sufficient to pay a gratuity of 20 per cent to the several elasses of stock holders. Scotia shareholders could afford to send the plant at Trenton and the furnaces, etc., at Sydney Mines to the scrap heap, and go on their day rejoieing, as the coal properties were still theirs, sure in the future, to be, what they had not been in the past, big money makers as there would be no interest or extraneous eharges, and gross profits would mean net profits.

To Scotia, until lately, it was possible to point as personifying the somewhat ambiguous ery "Nova Scotia for Nova Scotians." That eannot be said of it now, as Americans have taken eontrol of the helm. While bidding them welcome, they may be reminded that if success follows their entranee, it will be due to the faet that though old struetures may be torn down, the base, the foundation, solid and sure, was well and truly laid by their predeeessors in the directorate. The new super-struetures laid on the old torrent and tempest tried foundations, will be guarantee of future sueeess.

There have been numerous projects started and financed by Nova Scotians. In the writer's opinion 'Scotia' is among the very few that have been aeeredited with, from the start, being an uninterrupted sueeess. If in 'Scotia's' case the progress has

been gradual, success has been unqualified. Again resort is had to the trite saying "It all depends upon the management" and so it has been in the case of Seotia, a company all Nova Scotians well may be proud of. In all directorates there are, there needs be, men of different minds and varying characteristics. There are the sedate, unruffled plodders, and those endowed with a spirit of restless contriving, the one a complement to the other, and, combined, bound to command success, Scotia's board could claim men of varying temperaments and special qualifications; for instance Graham Fraser, of the indomitable will, could at times be quietly countered by R. E. Chambers of placid persisteney. It is related that Graham Fraser was not in favor of taking up submarine ares at Wabana, giving as a reason that the Wabana ores were similiar, in their action, to those of Alabama, that once the ore reached the sea, the iron ore would be cut off by limestone, Chambers held a contrary view. He said there was no limestone about it and his belief was that the ore ran out under the sea, and though the Board did not feel disposed to ignore the views of Mr. Fraser, neither did they all feel disposed to remove their minds from obtaining submarine holdings. Another member of the board supported Chambers; the two being diplomats resorted to strategy and finally Scotia became possessor of a couple or so of submarine areas, which rumor says netted the company on a sale being effected, nearly three hundred thousand dollars. All the members of the old board have gone hence, and have had enconiums passed on their life's work. All have gone except Harris, Chambers, and Cantley, and as Harris, being Chief Justice, is out of the running, there remain only two, Chambers and Cantley, and of these two it may be said they were in it from the first.

Of Chambers it may be said he did the actual development work on the ground, and he did it as a master builder not for the time, but in a sense for all time. He directed the quarrying of the ore,

at the inception of development work, and he is directing operations still, when the slope is out seven thousand feet under the sea. Chambers had joint responsibility in developing a method of loading ore and handling steamers which up to that time had been unheard of, so far as salt water borne ores were concerned. Chambers is one of the few who get there without seeming effort, or who make bulls-eyes the while observers have failed to discover they have been aiming at a target.

The writer might say much more of the part Mr. Chambers played in the building up of Scotia, but refrains, being of the opinion that he is one of those of whom it may be said 'He does wondrous work by stealth and blushes to see it in print.'

A more extended notice is permissible of Thos. Cantley formerly President and General Manager, —and at the present time Chairman of the Board— and this for several reasons. He has been more in the public eye; he has come in for severe criticism; he has been subject to villification while an active member of the munitions commission by the very men who benefited by his activities in the direction of demonstrating that Nova Scotia could produce steel and make shells as good as could be manufactured elsewhere.

Some one has said, "it is time enough to give a man credit for achievement when his mistakes are forgotten." That is a sentiment not to be endorsed as it may imply that no just enconium can be paid a man while in life, and further implies that the time for panegyric is after he has gone hence, when obeying the axiom, "speak no ill of the dead," men hasten not only to forget a man's mistakes but, as a common thing, all else about him. Thomas Cantley,—gazetted Honorary Colonel, at the instigation of that rugged, honest, blunt Sir Sam Hughes, of whom it may surely be said "With all his faults we love him still"— is one who has had large experience of all departments of the "Scotia" company, having served in the capacity of mechanic, clerk,

salesman, general manager, president, and, as at present, chairman of the board. He is credited with being first to see the advantages attendant on the company owning a large coal property and it was therefore in the true order of things that he should be sent to London to enter into negotiations with the directors of the General Mining Association for the acquirement of their mines and leases. This was no easy matter, though he took with him $100,000 to shake in the face of the Englishmen, as an inducement for them to give "Scotia" an option on the properties. But the G. M. A. directors were not easily led into temptation. Negotiations lasted for months. The meetings between the Englishmen and Mr. Cantley were conducted in the most formal manner. It is related that the G. M. A. directors could scarcely believe that so young a man was entrusted to transact so large business. Had he brought the option forfeit with him? Where was it? Had he power of attorney? Could he draw a cheque on the Westminster bank? Would the bank honor the cheque? When all these things were demonstrated to the satisfaction of the directors, they finally agreed to give an option, though at first they said they had no power to do so. It is declared that Cantley showed them a way out. One incident that happened at one of the meetings is worthy of relation, and the writer thinks it has the merit of being true. The option called for a payment of $1,500,000 in six months, and a forfeiture of $100,000 if the option was allowed to lapse. A discussion arose as to interest, the directors demanding that if the property was transferred, the transferee should pay interest from date of the giving of the option. After a long discussion it was agreed by the directors to relinquish any claim for interest. At this meeting the lawyer for the London board was absent. At the succeeding meeting he was present and insisted that interest must be paid. A director or two sided with the lawyer. The minutes of the previous meeting were called for, and it was explained to Sir J. Bridges,

who was late of coming, what had been agreed to at the previous meeting. There was a pause; Cantley made this penetrating and pertinent remark, "I remember my good old father saying to me, 'My boy ever remember that an Englishman's word is as good as his bond.' If you delete from your minutes the relinquishment of your claim for interest I will be forced to conclude that my father had too high an estimate of the word of an Englishman."

That brought forth the shout from Bridges, "By George, Cantley is right." "Mr. Cantley" said Bridges, "will you retire for a minute?" On being called back he was told, in substance, that the board would not be a party to lowering the high estimate placed on the word of an Englishman. Then the "steel" in Cantley came out, "Gentlemen, had you not referred to interest I should not have put forward the claim that my company get the interest on the $100,000 at deposit in the bank." And the claim was conceded. And so as a result of Cantley's diplomacy, combined with business ability, his company added to its great possession at Wabana, the coal mines at Sydney Mines.

After the company had acquired the Wabana ore deposits Mr. Cantley went to Scotland and England, and worked up a market for the ore among the iron masters of both countries. He also visited the great manufacturing centres of Germany and interested their heads in the use of Wabana ore. He followed this up in later years by having vessels of large tonnage, and suitable for the ore trade specially built, and chartered by the company for long periods of time. These vessels were of large tonnage two of them, as already stated, having a carrying capacity of 13,000 tons. He was always fond of the sea, and his special attention to transportation resulted in substantial earnings for "Scotia." Was it his love for this branch of the company's business that prompted him to induce his company to undertake the building of big steel steamships? He fought down any opposition and all difficulties, had

his way, undertook and completed the building of an ocean going steamer launched in 1917, one in the spring of 1918 and another in the fall. This work, though new, resulted in a profit to the company, and a benefit to the country, the while it made proud and glad the hearts of the folk in his native town. As one has said "Cantley saw what was wanted, and beat them all to it; while others babbled he built." His name is used instead of that of his company because his business associates readily grant that he was the prime, if not the sole, mover in the shipbuilding enterprise at New Glasgow.

Asked what he thought of Tom Cantley, one—in the trade—made the following declaration—in substance:—

There is no denying his being a man of vision, broadminded and possessed of unusual determination; instance—When war broke out and the steel manufacturers were suddenly deprived of orders and the industry was flat, it was Cantley who first saw the possibilities of our steel plants in the manufacture of war munitions and other materials. This was before the country was flooded with "experts." Many must distinctly recall the doubts raised that steel of sufficiently good quality for the manufacture of shells could be made by the open hearth process; but Cantley stoutly maintained it could be done, and undertook to do it. The result was that his company was the first to demonstrate that suitable steel could be made and shells pressed and machined to specifications. Others followed,—and those who were faced with the pressing needs of that first hour know well who it was that saw the way out. Against all opposition and gloomy misgivings he persisted; pounding, praying and bullying his steel-workers and engineers to greater efforts, until his firm occupied the proud position of being the first in Canada—perhaps America—to prove that a suitable shell could be manufactured from our Basic open hearth steel, and pressed and machined ready for use; and in a short time were shipping shell

blocks and bodies all over Canada to the various machine shops for finishing.

Thomas Cantley is a real Nova Scotia Scotsman, and that means an improvement on the real thing. He has all the good qualities of the race ,and a smattering of their weaknesses. He is as hard as nails, and as kindhearted as a child. He never blazes his trail, as he never anticipates turning back. Short of the goal, he does not know when to quit. His primary education was a limitel one, which made every step of his progress more difficult; but today he is well read, much travelled, and armed with a knowledge that only comes to observing men who pass along the highway of life equipped with good common sense and a desire to acquire the knowledge that makes life a success.

It is possible that Mr. Cantley never having been fortuitously compelled to fill the editorial chair may not be hardened to all criticisms, and might possibly demur were he assigned a bottom place on the form, and yet, than he there is no one readier to recognize and emphasize the sterling merits of his associates. For instance, were one to say to him, "What of R. E. Chambers?" The reply, sharply and clearly, would ring out "Chambers! Why, man, without R. E. Chambers there would have, for Nova Scotians, been no Bell Island and no Nova Scotia Steel & Coal Coy."

He still is a student of ways, means and men, and it is hoped he will long continue to occupy the prominent place he has attained among the many brave and busy builders of industry in this great Canada of ours.

Were it not for the exigencies of space, the number of subjects yet to be treated taken into consideration, there might be inclination to refer, at some length, to other of 'Scotia' directors. The three directors with whom the writer spent many cherry and chatty afternoons were Harvey Graham, Thomas Cantley, and R. E. Chambers; and as pleasant though not as frequent, President Harris, now Chief Justice. The writer will never be able to forget Harvey Graham, who had

charge of the coal end of the business. Probably it was through coal that he became acquainted with Graham, and through him with the others. His last meeting with Harvey was as follows: He had ran down to Trenton to see how things were running. He came back in the same tram car, sitting a little in front of Harvey. When the car stopped at New Glasgow, Mr. Graham, in passing out, flung a cheery 'good afternoon', but he had only gone a pace or two forward when ne turned back, held out his hand, and shaking the hand of the writer firmly, said "Good-bye". Proceeding on his way the writer could not account for his wondering, why there had been a double salutation. Surely it could not be possible that Harvey had a sudden premonition. Somehow the incident impressed him, trivial though it might appear. Surely it could not mean that ——————but it did. We never met again. That 'Good-bye' was his farewell benediction, at least the writer is gladdened when he thus construes and remembers it.

ADVENT OF DOMINION STEEL.

EPOCH NO. 4.

Just where to begin, and how to proceed, in sketching a history of the Dominion Steel Company, especially in the earlier years, is no easy matter. The difficulty lies in the fact that in its beginning many negotiations were entered into, some in their results tangible, a majority, possibly, intangible. It would not only be a difficult, but somewhat incongenial task, to attempt to frame a connected history of events preceding and leading up to the formation of the company, and, therefore, this chapter may be abruptly sketchy, rather than closely connected.

After the Scotia Company secured the Wabana deposit of iron ore, and realized its great extent and value, (this at a time when they were experiencing very great difficulty in obtaining sufficient ore in the East River district, and after they had expended a considerable amount of money in exploring and testing other reported ore finds in Nova Scotia,) Graham Fraser and his associates of that day, viz.: the late S. A. Fraser, John F. Stairs, Harvey Graham and Thos. Cantley, all became convinced that the future of the iron and steel industry of Nova Scotia was dependent upon smelting of Wabana Ore with Cape Breton coal.

It was known that the Cape Breton coals ran very high in sulphur, much higher than the Pictou coals, but it was the belief of the gentlemen who op-

erated the Ferrona furnace that with a modern coal washing plant such as they were then operating at Ferrona, the Cape Breton slack coals which were then a waste product, and hundreds of thousands of tons of which were on the waste dumps of Cape Breton, or left in the mines unhoisted—there being no market for them—could be washed so as to make a satisfactory metallurgical fuel. Negotiations to that end were opened with Mr. H. M. Whitney of Boston, and some 16,000 tons of Cape Breton slack were brought up to Ferrona, washed, coked and the Ferrona furnace ran for one week exclusively on coke made from Cape Breton washed coal. The result was quite satisfactory.

Negotiations were then entered into with Mr. Whitney for a continuous supply of coke, sufficient to supply two blast furnaces in Cape Breton. At this stage Mr. Whitney became keenly interested in the project. Negotiations were carried on for some little time, looking, first, to two blast furnaces and the corresponding open hearth plant being built by the Scotia Company at Grand Lake, near Sydney, and in which enterprise Mr. Whitney was to be associated with the Scotia Company. Later Mr. Whitney thought the Scotia proposal not big enough and proposed extending the operations to the building of four blast and ten open hearth furnaces at Sydney. That program Graham Fraser and his associates thought too ambitious, and negotiations fell through. Shortly thereafter other negotiations were entered into, which resulted in the Scotia Company selling the lower bed at Wabana, with the three square miles of submarine areas to Mr. Whitney, and the formation of the Dominion Iron and Steel Company followed in due course.

It might be added that after the first initial trial and washing of 16,000 tons of Dominion slack, and the subsequent week's run on the coke produced from that coal, and while negotiations were on for becoming associated with the Scotia Company at Sydney, Mr. Whitney proposed that a larger test be

made to confirm the initial one. This was agreed to by the New Glasgow Iron, Coal & Railway Co., and 50,000 tons of Cape Breton slack were shipped to Pictou Landing on the S. S. Louisburg, in continuous trips, railed to Ferrona, washed, and produced about 25,000 tons of coke. The Ferrona furnace was run continuously on this coke exclusively, and this big test fully confirmed the first experience in regard to its suitability for iron smelting. The coke ovens then installed at Ferrona were the Bernard, the first retort ovens built on this continent. By the way, the Louisburg, which took the C. B. coal to Pictou, was wrecked in 1918 and finds her resting place along with some three hundred vessels at a point on the rugged and ravenous, rocky, coast of Newfoundland On Thursday, 22nd June, 1899, a syndicate was formed in Montreal, with a capital of $20,000,000, to develop the iron and steel industries of Canada. The Dominion Iron and Steel Company was the name given to what was in those days looked upon as a gigantic concern. The principal sphere of operations, at least for the time being, was to be at Sydney, Cape Breton, so the announcement ran.

About 1893, or later, some members of the Dominion Coal Company took options on a portion of the property of the Nova Scotia Steel and Coal Company at Bell Island. The first option was allowed to lapse, and any option money put up forfeited. The reason given for this was that Mr. H. M. Whitney, the head of the Dominion Coal Co., would have his hands more than full for a year or two, in guiding the affairs of that company over the rocks and through the surfs by which, as a rule, all large enterprises are beset. And looking back, after a year or two's experience, none was more thankful than the President of Dominion Coal that the syrens had not sung sweet enough to allure him into the then projected steel and iron scheme. The difficulties encountered in the early operations of the Coal Company, were of such magnitude that it taxed Mr. Whitney's abilities, able financier though he was,

to the utmost, to steer his company safely through the breakers. From unexpected quarters, from those even who should have applauded his efforts, came the most violent, indeed, at times, most virulent opposition. Fortunately, strong and bitter as that opposition was, a stronger to meet it, and ultimately crush it, was found in Mr. Whitney.

In 1896-7, when it was seen that the Coal Company was entering into smoother water, Mr. B. F. Pearson, who was Mr. Whitney's astutest and first lieutenant, once more turned his thoughts iron and steelwards. At that time the purchase of the iron beds in Newfoundland had not been rationally considered. Indeed, it had been dinned into the company's ears that it was not necessary to go so far afield, as a big supply of ore, suitable for the company's purposes, could be had in Cape Breton. It did not take long, however, for those most closely interested to come to the conclusion that the success of the iron industry depended wholly on the purchase of at least a part of the Nova Scotia Steel & Coal Company's holdings in Newfoundland. Even with the probability of iron being discovered in Cape Breton, it was necessary, in the event of British or foreign capital being required, at least it would be very much more easily obtained, if the borrowers could point to a deposit actually in course of operation than to solely undeveloped areas, no matter how extensive the claims made in reference to them.

The names of the promoters, and officials of the Dominion Steel Company were: H. M. Whitney, Boston, President; R. B. Angus, of Montreal, Vice-Pres.; John S. McLellan, C. B., Treas.; B. F. Pearson, Halifax, Sec'y.; The Hon. George Cox, Toronto; Dr. Wm. Van Horne, Montreal; Hon. David McKeen, C. B.; J. W. Ross and Robert McKay, Montreal; J. Paget, England; Michael Dwyer, of Halifax, were among the directors.

The proclamation of the intended completeness of the plant to be erected at Sydney, and the predictions of the industries that were sure to follow in the

wake, softened greatly, if it did not wholly suppress, the bitterness that some felt towards Mr. Whitney, on account of the company's abandonment of some of the out of the way collieries. The Sydney people especially underwent a change of heart so great that instead of reviling him, as a heedless autocrat, and monopolist, they, after it was visible to the eye that steel works were being established, did him the high honor of conferring the freedom of the city—a city since—at that time a straggling, woe-begone village—upon him. To do him honor was their delight. A banquet, or reception, was tendered him in August, 1899. Acting upon the injunction 'Love your enemies'—critics—'and do good to them that (have) despitefully use(d) you,' Mr. Whitney in replying to the welcome of the Mayor, among other things said:

"We are partners in this great enterprise, and as a partner I call upon the people of Sydney to strive to have enacted, among other things, such legislation as will help to answer the prayer 'Lead us not into temptation.' All must co-operate in curtailing a traffic that injuriously affects not only the homes, but the business of the town. Who so strong as to be able to resist all temptation? Men and women, with their faces already turned hitherward, in search of work, beseech of you to answer for them the petition 'Lead us not into temptation.' Facetious critics say Mr. Whitney knew some in his audience and in this fashion paid them back for the censures they had heaped upon him. Be that as it may, the remarkable thing, for that time of day, was that the sentence was endorsed by loud cheers.

In replying to the address presented to him, Mr. Whitney further said:

"My belief is that the shipbuilding interests of the province will here be restored."

In a sense, Mr. Whitney's belief is about to be realized, though possibly, not in the exact way he had in his mind when he uttered it. It is, however,

true that the Sydney works are to have the credit of restoring the shipbuilding interests, and, not only of the province, but parts beyond. The company has been authorized, by the government, to proceed with the erection of a plate mill capable of turning out annually more than a hundred thousand tons of plate, of which the government has pledged itself, so it is declared, to take at least fifty thousand tons yearly. Without this plate mill profitable shipbuilding might not be restored to that extent desirable. Of course, steel ships have been built recently in New Glasgow, but much of the material used in their building was imported, and this might not be a profitable proceeding on the return of normal times. The new plate mill is to be one worthy, not only of the big steel works, but of the Dominion. Shipbuilding is one of the industries predicted to follow in the train of the steel industry.

When the Dominion Iron and Steel Company first began operations, a great future was predicted for the works, for Sydney in particular, and, indeed, for the province generally. Writers in 1898 predicted that the Sydney steel works would assume a position ranking ahead of any similar plant in Canada, and that has come true. Writing in 1898, the Canadian Manufacturer had this to say of the works then under way:

"Great as are the possibilities of Ontario in the development of an iron industry similar to that of the United States, bordering on the Great Lakes, those of Nova Scotia are infinitely greater in that the supplies of both ore and fuel are cheaper, more accessible, and not handicapped by a limited season during which winter transportation is unavailable, and it really seems that the recently organized Dominion Iron and Steel Company, who are now pushing the construction of their new furnaces, and other works in Cape Breton, having control of all the capital they may require, will soon be in a position to manufacture iron and steel at a lower cost than any other concern in the world. In addition to the com-

mand the company have of most of the known iron deposits of Nova Scotia, and in New Brunswick also, most of which are of inferior quality, they also own or control, some very remarkable deposits in Newfoundland, that are contiguous to deep water harbors that are accessible the year round. Nothing has contributed so much to the cheapening of iron in the West as the increased size of the vessels that navigate the upper lakes. It is well known that the larger a cargo a ship can take, the cheaper the freight rates will be. But there is a limit to the size of the ships that can go through the Sault Canals, and they would have to be greatly enlarged, and the lake harbors would have to be deepened, at enormous expense, before boats drawing twenty-four feet of water, such as can reach the piers at low tide, in a great many harbors in our Maritime Provinces, and Newfoundland, could be accommodated. Indeed, these provinces abound in magnificent harbors, capable of accommodating not only the largest ships now on the ocean, but much bigger ships than any yet built. . . . The iron ores in every section of the Maritime Provinces are within easy reach of seaports, and could be transported to Sydney or Louisburg, at all seasons of the year."

The foregoing article was no doubt inspired, and is probably overdrawn on a point or two. It seems, however, to confirm a belief of the writer of this which has been assailed. He happened to state to one conversant with the Nova Scotia steel industry that the Dominion Steel Company were, at the start, of the opinion that there was a possibility of much ore being supplied from supposed deposits in the province. To this the reply came that there were no ores in C. B., in sufficiently large deposits to meet their requirements, and that the works would never have started had the company not had the ores of Bell Island in view. Why then, it may be asked, did the company acquire rights of search for iron ore at many points in the province? If the company knew it must get its ore supply from Bell Island,

why take out rights of search, and options? Was it a case of pure diplomacy? Did they wish the people of the province to be kindly disposed, to the company, under the belief that it would set about developing the iron ores of the province? In the article quoted it will be noted that the author of it believed the old story of the geologists, that Nova Scotia abounded in iron ores. However, in fairness it must be said that if the promoters of the steel works were, at any time, under the belief that they could get ore in the province, the idea was not entertained for long, as Mr. Whitney, speaking in Sydney shortly after the work of construction had begun, said, among other things, that he could hardly restrain his enthusiasm when he thought of the possibilities of Sydney's future. Here in the home of the great basic industry of iron and steel, all other great industries will surely follow. On yonder land where construction work has commenced, I know that the raw materials for iron and steel can be assembled more cheaply than at any other tidewater in the world—limestone on our shoes—coal for metallurgical purposes, equal to the best in the world, and iron areas on the adjoining coasts of Newfoundland." Mr. Whitney, at this reception, predicted that before many years products of Sydney's iron works would be stretching across the continent and be borne by the British flag to every clime. He also believed that the shipbuilding interests of the province would here be restored. That latter was a fairly close prediction. If shipbuilding is not, as yet, on the programme, the next best thing is, and that is the production of plates and other material essential to the construction of ships of steel. The locating of the steel works at Sydney made Sydney Whitney captive. He had not been in their good graces previously; he had sinned grievously; for one thing in closing down the Victoria mines. Mr. Whitney knew how they had felt on that point, and took the opportunity of justifying the action of the company. His justification consisted in the declar-

ation that changing economic conditions had made radical departures necessary. Some of the changes were unpleasant ones, and had incited painful criticisms. Yet all had been done for the greatest good of the greatest number. And this sentiment went unchallenged. How true is it that it very much depends on whose ox is gored, and whose ox is patted. Eighteen months previously the sentiment would have been ridiculed, but at this time it was approved. all criticism being silenced in view of the great work being inaugurated by that heretofore spoiler, Whitney.

Speaking of the advent of the Dominion Steel Co. and, incidentally of the Nova Scotia Steel and Coal Co., then in active operation, the Hon. Mr. Fielding, former Premier of this province, and who, by the way, came in for his share of denunciation from the opponents of the sure-to-be huge Whitney monopoly, made the following remarks, from his place in parliament, containing propheeies which are already in a measure being fulfilled:

"It may be only a dream, but I am willing to entertain the hope, even though it be a vision, that as a result of the iron and steel industry we shall see a revival of shipbuilding in the Maritime Provinces. Nothing that has occurred in this province for the last half century has done more to create diffieulty, has been a more serious blow to the development of that seetion of the Dominion than the deeay of the industry of shipbuilding. It was the great industry throughout these provinces, not only the industry of building the ships, but the business of owning and manning them. Not only did our people build the ships, but as a result of the building of them, our young men all over our provinces grew up to be mariners, and sailors over every sea, and no doubt to that fact is due in very considerable degree the large measure of intelligence that is usually credited to the people of Nova Scotia, they were indeed people 'who went down to the sea in ships and did business in many waters. But, unfortunately, it is

part of the history of progress that there is no step taken in its march but someone is injured, however many may be benefitted, and in the great march of the development of modern civilization, the industry of building wooden ships has suffered. As we had the change in wooden ships to iron and then to steel, we now have the change from the steel sailing ships to steel steamers, and one can now buy a steel sailing ship for as much as would have been paid for a wooden ship twenty-five years ago. Not having an iron industry the business of shipbuilding has passed away with the passing of the wooden ships, as, with the development of the iron industry, not only on the seacoast, but in the west, I think we may reasonably hope to see the production of iron and steel plates for shipbuilding in Canada, and with the improvements that are going on there, there will be a development of the iron industry on the Great Lakes, and also upon the coast, and out of this I strongly hope we shall see a revival of the shipbuilding industries, which was of so great importance to Nova Scotia, New Brunswick and Prince Edward Island in by-gone years, and which would have great effect in promoting the development of our country."

In the chapter "The Coming of Dominion Coal," somewhat extended reference is made to the opposition it encountered. The coming of Dominion Steel ended the censures, which had continued without interruption for nigh five years. Up till say 1897-8 not a few of the newspapers took special delight in belaboring the Dominion Coal Co., and its chief promoter. Scarcely a paper had the courage, or foresight, to say that future generations would rise up and call them blessed, for the part played in promoting the industrial progress of the province. When the change in opinion came it came suddenly. A short year and the coming of Dominion Steel wrought the miracle. If in, say, 1897, there was anathema, in 1898 the shout was Maranatha, or its English equivalent. There was in 1897 still a remnant of the many who in 1893 bewailed the fact of

'foreigners' having in large part control of our coal industry, and yet in 1898-9 not a voice was raised when these same 'foreigners' entered upon a project which would, probably, give them largely the control of the iron industries of the province, if not of Canada. And why? Simply because the people's eyes were opened, and they began to believe that some part of what was promised might come true and if it did it would place Nova Scotia in the foremost place among the provinces, not only as a great centre of coal mining, but of the most important industrial and nation building pursuits. Nova Scotians were forced, possibly reluctantly, to admit that our own people would not have the courage to embark boldly in so extensive a project, because that they considered it so vast as to be utopian. The 'foreigners' had a wholly different reception in 1899 to that given them in 1893.

In the beginning of 'Steel' tremendous difficulties and discouragements were met with. Plans were either faulty or incorrectly interpreted. Money was expended in many instances to no good purpose, and a debt was thereby piled up, which for years interfered with solid progress. In spite of all, the company wriggled along. There were occasional peeps of light for, say, ten years, inspiring hope and courage, and four or five years ago the company went over the top, that is 'it made money,' and ever since it has gone on making it in larger proportion. Is it asked what caused the misadventures of the company in the beginning? An easy answer might be 'fortuitous circumstances that are inexplicable.' They could not have resulted from mismanagement, for all kinds of managements were given trial. Moxham, Shields, Fraser had each repute as highly experienced iron and steel men. Jones knew about the selling of rods, and Butler of the buying of rails. D. H. McDougall, the present General Manager, did not know, or profess to know, the last word that could be said in steel making, but, and it is a large and important but, he knew men. Carnegie, that

famous old Scot, made famous through his library and organ gifts, probably did not know how to puddle a bar, but he knew how to draw to him men who could. Carnegie selected with rare genius his staff, and his staff, in large part, made Carnegie. And it may be similar with the present manager of steel. He may not know the proportions of fluxes necessary to the turning out of No. 1 pig iron, but he has under him men who do, and that is everything.

The Dominion Steel Company has played a not unimportant part since the war began in the making of high explosives, from bye-products furnished by many coke ovens, and it is now entering upon work which will place it at the front of the steel industry in Canada. In the 1918 session of the Canadian Parliament, replying to questions, the Minister of Marine, Hon. W. Ballantyne, said that one difficulty which had confronted him when he first took into consideration the question of steel shipbuilding was that Canada had no plant for the rolling of steel plates. If Canada was to be a ship-building country it was necessary that a steel mill be established in the Dominion. He, therefore, took up with the various Canadian steel companies the question of establishing a rolling mill in the Dominion. The best proposition submitted by the government was that of the Dominion Iron and Steel Company, of Sydney, which agreed to install a rolling mill which would cost in the neighborhood of five million dollars, all of the money to be furnished by the company.

The contract which the government had entered into with the steel company was concluded on the following basis, the Dominion government guaranteed to take a minimum tonnage of 50,000 plates per year for five years. The price per plate for the moment was $4.15, but this would have to be adjusted every six months on the basis of the cost of steel ingots. The mill would run for six months, turning out steel plates, and then the price to be paid by the government would be determined. The contract

provided that no higher price than $4.25 should be charged to the government, and if the prices of ingots went down that of steel plates should be lowered accordingly. Government accountants would be placed in the office of the company to see that the prices were adjusted correctly. He further gave it as his opinion that the plate mill would probably be in operation in twelve or fifteen months. All machinery which the company had to import would have to pay duty on entering Canada, but this would be refunded to the company.

The General Manager of Dominion Steel is of opinion that strenuous times may follow the war and that the many small smelting plants, and small works for making munitions, which the war called forth will be unable to continue business after the cessation of hostilities. Of course, people take opposite sides on this point. He occupies the safest ground who is content to wait and see. The General Manager sees days of stress and maintains that the hope of the country will be the large and long established companies. In a paper contributed by D. H. McDougall, the General Manager of Steel, to the Canadian Institute or its Bulletin, he expresses the following views:

. . . It would seem advisable that the energies of the country should be concentrated on ensuring the future of the large steel works on Sydney Harbor and on the Grand Lakes and that the existing works should be looked to for the production of steel and iron in large quantities, because in those places only is available a sufficient quantity of coal, iron-ore and limestone. . . .

It is also advisable that any increase in the rolling and forging capacity of Canadian steel works should take place at the large and established plants referred to. These plants have hitherto regarded the manufacture of rails as their chief activity, but in the future, and with a view to after-war conditions,, it seems probable that the rolling of ship-plates and other commercial shapes will become nec-

essary. It is self-evident that the manufacture of finished steel products can nowhere be so satisfactorily and economically carried on as at the existing plants.

Considering particularly the question in what way it may be possible to obtain considerable increase in the production of iron and steel in the future, that is, after the war, the first point to be determined is: Allowing for the rolling in Canada of steel shapes and forgings now finished outside of Canada, for all the export business obtainable, and for all Canada's own requirements in iron and steel, what tonnage of iron and steel over and above the existing capacity of Canadian works will be required?

Summarising, and applying these principles, it would appear that the Canadian steel industry should be guided towards two main ends, namely:

That the present abnormal demand for steel should be supplied as far as possible by the extension of existing plants.

That these existing plants should prepare to enlarge the variety of their finished products.

That should it then appear there was a necessity for greater production of iron and steel such as to require new plants, these plants should comply with the factors that have already been named as requisite to commercial permanence, and as giving ability to compete in world markets.

By following along these general lines, the existing plants will be extended, rehabilitated and modernized, and given an opportunity to accumulate financial reserves to carry them successfully through the troubled days ahead, and they will be placed in a position enabling them to enter world markets, and to compete with other countries, particularly the United States.

Having given the opinion of an expert of one of the two big provincial steel companies it may not be amiss to give the views of a prominent official of the other. Their views while in the main similar

are on a point or two dissimilar. W. D. Ross, Vice-President of the Nova Scotia Steel & Coal Co., is pronounced in his views, and expresses them with emphasis. Speaking to a leading financial paper on the future of the securities of the steel companies, Vice President Ross, among other things, said:

"I have no two opinions about it. My contention is simply this: For the past four years the steel companies of the world have been producing next to nothing of a permanent nature. They are running to capacity. I will grant you that, but where is their output going? It is either going to the bottom of the ocean or being shot into the air It is all part and parcel of the period of destruction through which we are passing. And in the meantime what has become of the usual legitimate demand for steel products? It has been neglected of necessity. Many of the railroads are approaching the stage when part of their output is headed for scrap, and it is not being replenished. Structural work where steel is involved is at a standstill. The demand for steel is bound to be tremendous. It will take years to put the world back on its normal basis. Stop and consider the reconstruction work that will have to be done in the countries that are now the scene of fighting in Europe. The railroads of Britain are in need of steel the same as they are here. There may be a lull for a short time after the war, and in that time the steel industry should simply clean house and get in shape for the period of expansion that will follow. I can't see anything else to it."

From Mr. Whitney, the promoter of the big steel plant, down to the present time, those high up in the management of Dominion Steel have been most pronouncedly optimistic. Taking their utterances as confessions of faith there was, in their opinion, no limit to the future expansion of the steel industry in Nova Scotia. Their predictions were, in many instances ,thoroughly glowing, and though it is unlikely they will ever fully be realized, the signs point to a fulfilment to a noteworthy large extent. Nova

Scotians were told, in the early days of the undertaking, that if they made attempts to realize the effect the establishment of the plant, in Sydney, would have, not only on the steel industry of the American continent, but of the whole world they would come very far short. Mr. Moxham, the first Manager of Dominion Steel, was no doubt a big man with a big reputation. 'Twas he who built up the works at Lorraine, U. S., which were a revelation to the foremost men in the steel trade of Britain when they visited that plant—presumably prior to 1890. After surveying the works at Sydney, their surroundings, and all the facilities, he gave utterance to the opinion that gigantic as were the works at Lorraine, great as was their effect in causing a revolution in the methods of the production of steel, the works at Sydney were to effect a still greater revolution. Further, he stated, that up till a year or two ago it was imagined that the United States, with its immense coal fields, and its large areas containing iron ores, was, were, masters of the situation, and could dictate in the matter of steel and iron, to the rest of the world. "Today it is no longer thought that the United States can continue to maintain its preeminence. It must give way in the matter of cheap iron and steel production to Nova Scotia," and Mr. Moxham added, and mark the words, "Nova Scotia today holds the key to the steel production of the world."

When one considers the supreme importance of the steel trade, and the vastness of the interests involved, he is inclined to wonder if Mr. Moxham gave expression to views he really held, and believed. At the time the startling statement was made Mr. Moxham could not afford to sully the splendid reputation that he had attained, by indulging in fairy flights of fancy, simply to tickle the ears of the people, among whom he had come, for a time at least, to dwell. There may have been warrant for his utterance. Like some of our own iron masters, he may have possessed the gift of seeing visions. He

may have mentally surveyed the field from where the United States drew her ore supply; he may have calculated how long that supply would last, and had come to the conclusion that long before the ores at Wabana had been more than tapped, the known iron ores in the United States would have become all but exhausted. Therefore, the writer thinks Mr. Moxham made the statement in good faith, and, with him, believes that while Bell Island is hers, to have and to hold, Nova Scotia, in deed and in truth, holds the key to the steel production of the world.

Having referred to the part Thos. Cantley played in the promotion of the steel industry, a brief sketch may be in place as to the characteristics of the one now in charge of this great and growing plant of the Dominion Steel Corporation.

When thirteen years old, Donald Hugh McDougall, now, for short, called D. H., it being taken for granted that any one who does not know what the letters stand for, makes confession of gross ignorance, left the common school at Glace Bay, in the eighties. Wages of grown ups were low and it was necessary for the youngsters to supplement the wages of the head breadwinner. In those days it was not necessary before obtaining employment that a boy should produce a certificate, as to scholarship, from his school teacher, and so it came about that at an early age the boy was introduced to somewhat trying manual labor in a coal mine. At Reserve he worked on a steam shovel and attended boilers. In Dominion No. 1 he loaded coal at eight cents a ton. That was a cent a ton more than paid the loaders, from a stumpy coal floor on the mainland in the seventies. When the Sydney and Louisburg Railway was being constructed, he travelled with the surveying parties. Then he was an apprentice in the Central Machine Shop at Glace Bay, from which he was dismissed for a boyish prank. This, probably, though he did not think so at the time, was the tide in his career which led to fortune. C. M.

O'Dell, Chief Engineer of the Dominion Coal Co., took hold of the lad and gave him work as Survey Chainman at the fair wage of a dollar and a quarter a day. Mr. O'Dell was doing the engineering work when the Dominion Iron and Steel Co. were engaged in preliminary preparations. From chainman, in short time, D. H. was promoted to the head of a survey party, and when Dominion Steel took over its own engineering work he was given charge of the survey staff. Afterwards he was engineer in charge of construction work. This was rapid promotion and merited, for he had proven his worth by faithful service. His day's work done, he devoted himself to study, and took advantage of the Government Mining School, and a course in the International Correspondence Schools. He left the Steel Co. in 1902 and became Assistant Resident Engineer of the New York Central and H. R. Ry. In 1904, by request, he rejoined the Dominion Iron and Steel Co. as Manager of the Iron Ore mine at Bell Island. The two years he spent in New York were of immense advantage, as they gave him opportunity to attend college classes at night, and gratified a bent for a larger grasp of engineering.

The iron ore mine of the steel company, on Bell Island, needed a practical and energetic head. D. H. filled the bill. The entire surface plant had to be planned and constructed, and the mine developed. Within three years this was accomplished, and today the mine has an excellent modern plant. The electric hoist installed is claimed to be the first of the kind in Eastern Canada, possibly in the eastern continent of America.

In 1907, Mr. MacDougall was appointed Superintendent of Mines and Quarries of the Steel Company. During the three years he spent as Superintendent he had large opportunities of prospecting for coal, iron and other minerals. It was during this period that the Birch Grove Coal Properties were acquired by the Steel Company and they have proved valuable beyond all expectation. In these, as in

preceding years, he found time to attend the Summer School of Science, under the instruction of Professor MacKay, of Halifax, who taught mathamatics and chemistry, and Professor Woodman, who taught geology.

In 1910 when the Steel Company gained control of the Dominion Coal Company, Mr. MacDougall was appointed Assistant General Manager at the Collieries. The position was a most difficult one and for two years was very trying and discouraging. The United Mine Workers had conducted a strike for upwards of a year, while members of the Provincial Workmen's Association continued at work. Strife reigned in the colliery villages and towns, and bitterness and hatred rankled in the minds of many workmen, both against their fellow workmen and the Dominion Coal Company. Social and industrial life were greatly perturbed. Into this seething cauldron of passion was thrown D. H. "Could he bring peace out of such discord?" was the question. Many doubted and not a few foretold of failure and worse conditions to follow.

It might be an easy thing to deal with inert matter, to survey land and compute distances, but to successfully handle thousands of warring workmen, that was another and bigger question. Close application to business and to the study of books might no doubt accomplish much, but to link up the human machine to the great industrial side of life and to keep both harmoniously moving forward was a complex problem, far beyond the power of this youthful stripling.

Mr. MacDougall not only succeeded in restoring industrial and social order, but during the two years he filled the position of Assistant General Manager, and the following four years, when General Manager, no strikes occurred, not even a boy strike, the nearest approach to anything of the kind arising from the action of a Town Prosecutor, who seized the beer of Italian workmen, some of whom in protest stayed off work for a day or two. During those

years the outputs of the Dominion Coal Company increased rapidly, the daily output being close to 20,000 tons previous to the outbreak of war.

Mr. MacDougall has all the qualities requisite to success. A big man, with a big make up, the human element is strong in his breast. That "little touch of nature which makes the whold world kin," throbs through his whole being and attracts men to him. An open countenance, a genial manner and a sympathetic nature are natural traits of his character. He has a keen insight into human affairs and has a thorough knowledge of workingmen, with whom he is in deep sympathy. He came out of a workman's home, and to him the workingman was always an open book, which he read without the aid of an instructor. Again, he early acquired the habit of thoroughness, and attacks no problem until he is sure that he can carry it through. He puts first things first and no labor, however great, is too much for him when preparing for difficult tasks ahead. He has the courage and determination of the Celtic race and rebuffs only serve to stimulate him to further effort. His motto is "work and more work" and if within twenty years, the boy who began work at a dollar a day is now General Manager of the Dominion Steel Corporation the second largest industrial concern in Canada, it is because of his capacity for work, developed through incessant toil and study; if for eight years industrial peace has been unbroken by strikes, much progress made, and industrial expansion accelerated, it is in large measure due to his ability, foresight, and, that most valuable asset, self-confidence, free from any taint of self-conceit.

A FORTUNATE ESCAPE.

Much credit is due the Fielding Government—Liberal—for having in 1893 introduced legislation giving practical demonstration of a desire to assist the Coal trade, although such assistance was to be neither by way of a bonus nor a remission in part of the royalty. Without doubt the legislation of that year was a potent factor in the marked impetus given the trade in the years succeeding. It may be well to bear in mind however that the Fielding Government was not the first to come forward with a big proposition whose main object was to assist in a more rapid expansion of the coal trade of the province.

Another Liberal Government has to be applauded for its good intention. While it has proven to be a fortunate thing for the province that the "Whitney legislation" as it was called at the time—passed in spite of very strenuous opposition in 1893, it has also been demonstrated that it was a fortunate thing indeed that the legislation of 1872, which was enacted without clamour, never became effective, because, to use a familiar phrase, there were no takers, or in other words, it never became effective through lack of vision. Looking back and considering happnings since 1872 it is possible to say of the Government of that day that it loved the coal trade, not wisely but too well. It was a lucky escape for the province that the Government's lavish offer fell on timid ears. Had the offer been accepted the

treasury of the province for a long term of years would have been in a precarious position. It should be interesting to the younger generation if the proposition of the Government of 1872 be given here a place, so let the story be told:—

In 1872, the then Liberal Government concluded that some stimulant was necessary to dispel the lethargy into which the coal trade had fallen. It had begun to be realized, in the year preceding that the production of coal was not proceeding at a satisfactory rate. The sales that year did not exceed 600,000 tons. In view of the long period in which coal mining operations had been carried on, it was considered that so limited a quantity indicated an unsatisfactory rate of progress. The Government of the day, having at heart the general prosperity of the Province—a claim by the way put forward by every government—considered it incumbent to offer some inducements to stimulate expansion. This it would strive to accomplish by offering to grant subsidies and allow remissions of royalty on coal to any company willing to build railways opening up certain sections of the country. Presumably, preference was to be given to the builders of roads running through mineral lands. By an Act passed in 1872 it was resolved that "A grant of Crown lands in the County of Cumberland not exceeding ten thousand acres shall be given to the Parrsboro' and Springhill Coal and Railway Co., or to any other incorporated company, or to any company that may become incorporated, that will engage to construct a railway from Springhill to Parrsboro' with suitable appliances at such last named part, adapted to a large mineral traffic, together with an annual subsidy to such company equal to one-half the royalty that shall be annually chargeable under the now existing law, on all coal carried over such railway for fifteen years from the completion of the same."

These were liberal terms, but of infinitesimal importance as compared with those proposed to be

given to any company that might build a road from New Glasgow to Louisburg. To such a company was to be given a grant of 150,000 acres of crown lands, and half the royalty on all coal raised in Cape Breton for a period of forty years. Here surely there is a striking instance of opportunity unregarded. Had the incorporators of the Louisburg extension Railway been possessed of foresight and taken advantage of this, their opportunity, they would have made themselves and their company rich and famous, and by an exercise of the privileges offered would have all but made bankrupt the exchequer of the province. The capitalists of that day were as shortsighted as the Government was rash and unforseeing. It may not be lost time to figure up what the incorporators failed to quickly grasp and what the country gained by their failure to embrace so large an opportunity. The royalty concessions were to begin on the completion of the road. Had the road been started in 1872 it should have been finished at the end of 1876. From 1877 to 1916 both years inclusive, there was sold in Cape Breton a quantity equalling 82,000,000 tons which, at half the royalty placed at 5 cents a ton amounts to $4,100,000. By the end of the forty years the company would have received by way of a royalty a bonus of say $820,000 over and above the total cost of construction and equipment of the road; the length of the road estimated at 164 miles and the cost per mile $20,000. And then to the back of this was the big land grant. To the present generation, it must be gratifying that the capitalists of those days and contractors were lacking in enterprise or foresight. The moral to be drawn is that it is at times unwise to legislate too far into the future.

A SECOND UNACCEPTED OFFER.

It has been stated by certain public men professing to have knowledge of events occurring nigh forty years ago that Nova Scotia had a second lucky escape from entering into a bad bargain, when its request to the Federal Government that the province be paid a certain fixed sum yearly in exchange for the relinquishment of the royalty on coal, failed of acceptance. It has been declared by some that this arrangement was to be of a permanent nature. The opinion has been expressed and may be held in certain quarters to this day that had the proposed deal been consummated there would have ensued in later years a serious financial loss to the province, indeed that its financeswould have been for all future time seriously crippled. Those who held these beliefs and expressed these opinions, spoke without any accurate knowledge of the facts, for the arrangement proposed by the Holmes and Thompson government in 1880 instead of tending to impair would have been of great assistance to the provincial revenue. The acceptance of the proposal viewed from a provincial standpoint would have been an excellent bargain as will be gathered from the excerpt taken from Appendix 10 of the Journals of the House of Assembly for 1880:—

> " We propose that the Dominion Government shall relieve the Coal owners of this Royalty and pay the Province of Nova Scotia

a compensation for the same of Two hundred thousand dollars per annum—the arrangement to be and continue in force for five years."

Had the proposal been accepted by the Dominion Government the Province would have benefitted handsomely.

The coal sales 1881-1885, both years inclusive, reached in the vicinity of 6,000,000. At seven and a half cents a ton the total of the royalty to be collected in the five years would not have amounted to more than $540,000. The amount asked for from the Dominion Government was $200,000 a year or a total for five years of $1,000,000. It will thus at a glance be seen that had the "arrangement" been entered into the province would have been a gainer by over half a million dollars. As hinted, the Government of 1880 has been laughed at and criticized for being authors of a proposal that would have been disastrous to the province. Those have overlooked the fact that the arrangement was to extend over a period of five years only. The writer is among those who owe the Holmes-Thompson Government an apology. He accepted the inaccurate story of the arrangement without proper inquiry. But for enquiries made, rendered necessary to a proper presentation of the details of the arrangement, he might still be under the belief that the Government of 1880 was inclined to be as profligate as that of 1872.

IRON ORE MINING.

As stated in a previous chapter there has been much controversy over the question as to the extent and quality of Nova Scotia's iron ores. The one deposit that had been fairly well prospected was Nictaux, and based on the work done there, the statement was made that the deposit contained 300,000,000 tons of ore, and about the time that statement was made Wabana was credited with containing about 150,000,000 tons only. Also at that time the fabulous value and extent of the ores of Wabana had neither been realized nor appreciated. If, as at the time stated, Nictaux deposits contained twice the quantity of the Wabana field, how did it come about that the Nova Scotia Iron masters did not prefer the Nictaux to the Wabana ores? The latter, it is true, could be worked more cheaply, but as there was a bonus of a dollar a ton on steel made from native ores the difference in cost of mining, etc., could not have been the inducement to mine at Wabana instead of at Nictaux. There were undoubtedly other reasons.

The writer, while demanding proof in support of the oft repeated assertion that Nova Scotia had abundance of merchantable iron ore, admitted that the Nictaux field might be valuable and that it was the only district yet exploited which gave promise of being valuable. There is ore at Nictaux, no doubt, but the quantity is far short of the statement made by the "recognized and disinterested authority."

The latest developments go to show that Nictaux ores are not commercially as valuable, for the time being at least, as those of Wabana. The preference given to native iron ores and their products about 1900 and forward had no appreciable effect on, nor did it act as a stimulus to production. In 1884, with preference, the quantity mined was 54,000 tons; in 1896 the quantity mined was 56,000 tons, or only two thousand tons greater. When the iron ore bounties were in force, amended legislation, in 1897, placed no limitations, as to Canadian ores on the bounties payable on puddled bars and steel billets, every ton of which was entitled to a bounty of three dollars. The result of this policy, it was alleged, was to reduce the production of iron ore in Nova Scotia, from 58,810 tons in 1896 to 16,172 tons in 1902. Looking back it may surely be declared that the result of that policy was more beneficial than harmful, even though it may have resulted in a lessened production of Nova Scotia ore—a debateable point. Under the policy which favored Canadian ores, and also their products, iron ore mining in Nova Scotia did not increase, but as stated, perceptibly declined. Had the policy been continued, the probability is that iron ore mining would be, as it is today, at a standstill, for the simple reason that it is hard to name a locality containing a sufficient quantity of ore of the requisite quality, to warrant the installation of a modern mining plant. Let it be admitted that the government policy complained of in 1905 did not at all conduce to iron ore mining and steel production, yet, as between mining and manufacture, it is scarcely necessary to say that the products of iron ore contributed much more, in the numbers of men employed, the capital invested, the amount paid out as wages, and to the prosperity of the province at large than the mere mining of ore. Had not the government in 1897 amended its policy there would not be today the extensive plants at Sydney and Sydney Mines. The policy at the time of its inception, harshly criticized, must be given the

eredit for the inauguration of the steel industry on an extensive seale in Nova Seotia. This must be said while it may be a matter of mueh regret that iron mining in Nova Seotia has eeased for the time being.

Referenee has already been made to the opinions of many eminent geologists in referenee to iron ore. Further referenee may be permissible. In a work published in 1860 by that eminent authority, Sir Wm. Fairburn, it is stoutly deelared that "In Nova Seotia some of the riehest ores yet diseovered oecur in boundless abundanee." If the assertion was even partially true it would at this time have to be deelared that Nova Seotia has utterly failed to take advantage of her opportunity. After the lapse of more than half a eentury there has been no demonstration of the aeeuraey of Sir William's assertion. Sinee the statement was made, no one has boldly eontradieted it, while there are many who hold the opinion that it may be correet, and yet not a single loeality can be pointed out to whieh it ean honestly be applied. It may be true that the demonstration is laeking, and these times that is everything. The question resolves itself to this, "Have brave, praetieal attempts been made to diseover ore of eommereial value, both as to quality and quantity? They have. The two steel eompanies in Nova Seotia have spent many thousands of dollars in an effort to find deposits worth the working. But apart from the large sums spent by the steel companies, private individuals have spent much time and money in efforts to loeate deposits. There was, following the establishment of the Dominion Steel Company, a rush in 1900 to secure areas supposed to contain iron, as great as that supposed to eontain eoal, following the advent of the Dominion Coal Co. in 1893. Prospeetors set to work gathering all possibly proeurable iron ore legends of the eountryside. Plaees whieh years ago were said to contain iron ore of more or less, or of unknown quantity and quality, were minutely seoured, and in many instances covered by rights of

search or lease by the more adventurous. Antigonish and Guysboro were in that year the favored prospecting field. In that year, the largest number of Rights of Search ever taken out at one time were secured by Halifax parties. No less a sum than $1440 passed through the hands of the teller of the Mines Department, for licenses or rights for iron ore. One group of prospectors took out no fewer than forty-four rights of search. Iron ore prospecting, and even iron ore mining was no new thing for Guysboro County. Many years ago, possibly over fifty, a United States company opened a mine at Bolyston. The ore was specular, of good quality. The lead, however, was not a large, or thick one, and was abandoned after a short time, the cost of production and transport being too heavy to warrant continued shipment.

The Georges River iron boom was a most spectacular one. A seam, it was declared, had there been discovered. The geologist of one of the steel companies who happened to be in London at the time, was summoned home by cable. He went carefully over the ground and was assured that the seam of ore was 1,000 feet wide and had been traced for miles. Many pits had been sunk, the iron in each having been declared good, and yet, after all, further exploration demonstrated that there was no continuous lead of economic value.

A somewhat similar thing occurred in the search for iron ore at Whycocomagh. Three pits were sunk, in a row, in what was supposed to be a lead. The distance between the pits sunk was say 125 feet. Between the pits at equal distances two other pits were sunk and no ore found in either. This damped the ardor of the prospectors. The lead or vein was not continuous.

It is claimed that iron ore may be found in Inverness County, here, there and everywhere. The assertion is all but absolutely correct. It has been found in many localities, but not as yet at any one spot to incite to vigorous and systematic exploita-

tion. Prospecting by drill and shaft and tunnel have been employed in an effort to discover an encouraging body of ore, but no real success attended these efforts. Attempts to sink and tunnel more determinedly were discouraged by the results of tests made in the course of prospecting. A thorough analysis showed that the average of iron was say 46 per cent., three or four points below the average of the ores now being used by the steel companies.

So long as a higher grade of ore is obtainable, the ore at Whyeocomagh will remain idle unless some pecuniary encouragement is given by the government. There are some fine ores in other parts of the county. At Upper Glencoe more than one attempt has been made to discover a body of ore large enough to warrant extensive research. The quality of the ore in this district is high. In 1917 one of the steel companies did a fair amount of exploiting at Glencoe. There was considerable extent of outcrop and the company mined about 400 tons open cut. In diamond drilling, however, no place was found where the ore seemed to go any depth. The ore shipped to the furance was of very good quality, averaging about something over 60 per cent. iron and low in phosphorus, making a good ore for use in the open hearth. In some parts of the outcrop the ore was inferior and not good enough to ship. The ore was hauled to Glencoe Station, nine miles distant. Owing to long haul and shallow depth of deposit, the operation was not profitable. The ore is known over a distance of about 2200 feet, but the company are not of the opinion that it is continuous ore of high quality, but rather detached bodies, or pockety. The other of the steel companies had spent considerable money in the district, but had for some reason abandoned it. The vein is associated with limestone and granite, the drill holes sometimes bottoming in the one and sometimes in the other. The body worked by the first mentioned company was about twenty feet wide on surface, but the drill in many cases went through the ore at a

distance of two to twenty feet. Of course, it may yet be found to extend to a further depth, but if it does, the spot has not yet been discovered.

THE FIRST N. S. MINE INSPECTOR.

In the report of the Nova Scotia Department of Mines for 1864, one reads an expression of regret from the then Chief Commissioner, P. S. Hamilton, that a Mine Inspector had not as yet been appointed. From this a vast majority of the people of the present day have come to the conclusion that John Rutherford was the first Inspector. In this, however, they are mistaken. An Inspector had been appointed several years previous to Mr. Rutherford being called to the office. As will be gathered from the document appended James McKeagney, of Sydney, was the first holder of the position. The document not only intimates his appointment, but enumerates his duties. Just what instructions are issued to the several inspectors of the present time is not known, at least not in detail. Mr. McKeagney took sick just after his appointment and this fact seemingly was not officially known to the Department for three years. After he had been rendered incapable of doing his work, a committee, appointed to inquire into affairs at the mine, expressed surprise that the fact of Mr. McKeagney's illness had never been noticed; and recommended a new appointment, as it was not thought that the then Inspector would ever be capable of fulfilling his duties. In those days coal mine inspection was not the fine art it had been reduced—or elevated to, in, say, 1918. The Deputy Mine Inspectors of the present day, who are virtually the Inspectors, have not only to report to the Deputy Commissioner monthly,

or oftener, but to make a report for the workmen every time they visit a coal mine. However much of a joke it may have been fifty odd years ago, it is no sinecure today:

Provincial Secretary's Office,
Halifax, Jan. 2, 1858.

Sir,—The Lieutenant Governor having by the advice of the Executive Council appointed you to be the Inspector of Mines in this Province, I am commanded by His Excellency to transmit for your guidance the following instructions.

—— 1 ——

It will be your duty to exercise a general supervision and inspection in reference to the mining interests of the Province (subject to such qualifications as the Local Government or the Legislature may see fit to direct) and you will be expected to report thereon annually and to submit for the consideration of the government, any suggestions that it may appear to you to be advantageous to adopt for the protection of the public interests or the due development of the mineral resources of the Province. With your report you will forward two copies for the use of the Legislative Chambers.

—— 2 ——

You are directed to make personal inspection of all or any mine which have been or shall be opened or are in operation by virtue of any lease or other authority from the Crown or from the Provincial Government, when and as often as you may see fit so to do, and at uncertain periods, but at least once in each quarter, and you are to furnish a report of their state and operations for the information of the Government.

—— 3 ——

You will satisfy yourself that the mines are worked by the lessees or tenants according to the conditions of their contracts, and that the terms thereof are conformed to by them in every particular—or, if otherwise, you will report any deviations

or irregularities that may occur.

—— 4 ——

The books of account of the lessees will at all times be open to your inspection, and you will take copies thereof or of any entries therein as occasion shall require, or as you may see fit, from time to time, and in conducting your examinations of the mines and the survey of the works thereof, you will call for the assistance of the officers, servants and workmen employed therein when you deem the same to be necessary.

—— 5 ——

All permits for the shipping of coals at the mines will be signed by you or one of your deputies, as a check on the deliveries of coal and the accuracy of the returns of the quantity.

—— 6 ——

The Weighers and the Harbor Masters will be under your immediate direction and will be furnished with such instructions as may appear to you necessary for the effectual performance of their duties.

—— 7 ——

You will receive from the coal weighers certified returns on oath of the quantities of coal shipped by the lessees and transmit the same in triplicate yearly to the Provincial Secretary for the information of the Government, and you are to certify the correctness of the returns to the best of your belief.

—— 8 ——

You will also transmit monthly returns of the number of vessels loading and the quantities of coal shipped, with the names of the vessels and the masters and their destination.

—— 9 ——

The return required to be made by the lessees will be received and transmitted by you for the information of the Government.

—— 10 ——

Copies of correspondence relating to the mines and minerals of the Province are herewith enclosed. It will be found to contain a statement of the terms

on which the mines have hitherto been held and are proposed to be leased, any further information you may require will be furnished on your application.

—— 11 ——

It is proposed to assign as your remuneration or salary of three hundred pounds per annum, exclusive of necessary travelling expenses, to commence from the date of your appointment, subject for its continuance to the approval of the Legislature, and you will without delay proceed to qualify yourself for your duties and enter upon their performance.

—— 12 ——

You are requested to acknowledge the receipt of this communication, copy of which will be transmitted to the Agent of the General Mining Association for their information, and you will be supplied with such further specific instructions as may on your suggestion appear to be necessary or as occasion may from time to time require.

I have the honor to be, Sir,

Your most obedient servant,

(Sgd.). CHARLES TUPPER.

James McKeagney, Esq.,

Inspector of Mines in Nova Scotia.

THE WONDERFUL ISLAND.

So far as the seareh for minerals, other than eoal, Barytes and limestone, is eoncerned, it may be said that Cape Breton is not only a wonderful, but a mysterious island. Nature disported herself gaily when distributing her gifts over the land, throwing a pieee of one kind of mineral here, and a piece of another there. Scareely a metal that ean be named, but a pieee, or a poeket of it has been diseovered at some point or other. Cape Breton, in days previous to the war, had beeome famous from her periodieal booms. At one time it was gold, in river sand, or rivulet pebbles. At another time it is gold in eonglomerate roek. One year it is a eopper boom, next year it is a eoal boom, in the vieinity of Sydney. There have been iron booms, eopper booms, Anthracite eoal booms, and oil boring booms, not to speak of the galena, wolfram, zine, lead, and other booms. But, alas! the Anthracite that was boomed turned out to be blaek shale, good shale, no doubt, but not much of it.

Relating experienees, one who like the writer, has done a great deal of prospeeting, has this to say: "On my various travels, and explorations through Cape Breton, I certainly have been struek by the diversity of minerals to be found distributed in a most erratie manner all over the Island. The knowledge I have gained of them is largely superficial, and therefore I eannot write authoritatively. For what it may be worth I give, from memory, the

name and location of the different minerals which have come under my notice. On my first visit to Cape Breton—more years ago than I care to count—I was asked to look at a "copper" property at Eagle Head, near Gabarous. There had already been a shaft sunk, and considerable money spent on exploration, but my knowledge of copper was a blank, and so no opinion was offered. About the same time copper mines at Coxheath, near the head of Sydney Harbor, were being developed. On more than one occasion I had dealings with the management in connection with the work. The report of Mr. Peters, an eminent copper expert certainly was most favorable, in fact almost flattering, of the quality of this copper. Some years later a report of one Mr. Brown, of Chicago, gave a very high opinion of the prospect development that was carried on at intervals, over a period of some twenty years, but at present, though there were reports a year ago of further work about to begin, unfortunately, it is still idle.

In iron. I was introduced to the iron mines near Whycocomah, known as Iron Mines Brook. Mr. Jennison, at one time mining engineer, of the D. I. & S. Co., explored this and stated that he had found some very rich samples of iron ore, but only in sample lots; also the same report from a reliable authority has been given of iron ore prospects lying some distance up the Mira River, but again only sample lots have been found. Iron ore in considerable quantities has been found on George's River Mountain, within about seven miles in an air line from North Sydney. A lot of prospecting has been done on these areas, and at times stories, which are simply fabulous, have been told of both quality and quantity of the iron ore there. These areas are still undeveloped.

Gypsum, as you no doubt know, abounds in large quantities on this Island. Much of it is of poor quality, but a chemical analysis which was made of gypsum near the mouth of Mabou River on

the west side of the Island, showed it to be of very high quality. Two different deposits of Tale or Soapstone have eome under my notiee; one of them at Brigend, near Whycoeomah, and another on the shore between Louisburg and Kennington Cove. This latter port is the Cove made famous by the landing of Pepperel when he undertook the siege of Louisburg. From persons who were spending their money in the development of these two prospeets, one learned that the quality was exeellent, but the quantity so small that it would not pay to develop on a large seale.

Gold has been mined to some extent in the vieinity of Baddeek, but apart from newspaper reports and the glowing aeeounts of a man who tried to sell some stoek in his eompany, I know nothing.

Some few rieh samples of Plumbago have been mined at Banaeadia Mountain near Grand Narrows. These areas were owned at one time by the late H. F. MeDongall, M.P., and on at least two different oeeasions, eonsiderable money was spent in prospecting and developing. Again the eomplaint was laek of quantity.

Manganese, so neeessary in steel making, is known to exist, in small quantities at least, near Catelone in quite elose proximity to the Sydney and Louisburg Railway. The owner of this has used this manganese mine as a lever with whieh to pry the S. & L. Company away from some of its money, when it beeame neeessary for the eompany to buy a railway right-of-way aeross his farm. Other than that there is no positive knowledge of the aetual value of it.

Barytes is known to exist in the vieinity of Lake Ainslie, and, in faet, has been mined and exported from Whyeoeomah for some years. Mueh of the white lead whieh we buy for painting purposes is adulterated with Barytes from this mine.

For fifty years petroleum has been known to exist in the vieinity of Lake Ainslie, and in its erude state has exuded from roeks in sueh a way that it

has been caught in cans by the nearby residents very much as maple sap is caught. I have known of this petroleum being used for lubricating purposes on carts and farm machinery. Systematic boring and exploration have been carried on for many years and quite a large amount of money expended in this way, but up to date no gushing well has yet been located.

Silver lead with graphite has been found of high quality in the East Bay Mountain, some fifteen miles from North Sydney. Traces of copper were also found in this same vicinity. Some two years ago an expert appeared and undertook the development of these areas.

I might say here that this claiming-to-be-expert was one of the most optimistic men I have ever met amongst mining engineers or explorers, and some wag claimed that he was the original mining engineer on whom that old gag was got off—"Positive— liar; comparative— liar; superlative—mining engineer."

Some very rich samples of silver lead have been taken from this East Bay section, in fact, some of them by the writer, but again the quantity was lacking.

Fire clay of a very fine quality was found in connection with the famous 13 ft. seam in the Inverness coal region.

A geological formation with which I am not familiar, is known to exist in considerable quantities near Bell's Creek, at the head of the Sydney Harbor. This has been tested and found to be of the same composition as the material of which the famous Scotch firebrick is made. A company was formed to operate this, of which the late Graham Fraser was the moving spirit. Mr. Fraser's death unfortunately stopped all work in this connection, but from what I have seen and heard of this, it is still worth further investigation.

Tungsten and Molybdenum were both claimed to be found in Inverness County in the vicinity of Cheti-

camp, but of this I have no personal knowledge other than newspaper reports which I have read.

Cannel coal in veins of at least twenty inches thickness has been unearthed by the late Pat Neville and myself in our coal explorations."

There are those who still have hope that systematic exploration will yet bring to light some of the minerals referred to, in quantities sufficient to be of commercial value. Among these is Prof. Woodman, Associate Professor of Geology, Harvard University. Sent at the instance of the local government to spy out the land, he made his report. A portion only is given as follows: "Owing perhaps to the late opening up of the county, and in part to the fact that there is in Cape Breton no one series of ore bearing rocks of wide extent, easily recognized, the Island has not received in the past the attention paid to equal areas of the mainland of Nova Scotia. In this we must except the interest in the coal formation of the Sydney basin in the east. Moreover, for some reason, difficult to discover, the firm belief appears fixed in the minds of many, that nothing good of a metallic nature can come out of the Island. That this is a false impression any one can learn by a sufficiently careful study of the rocks. There is no doubt but that the region occupied by the older rock is one in which a number of districts are capable of successful development if judiciously handled, with the proper distribution of men and money. I am the more pleased to have arrived at this opinion, because it has been reached by direct field work, influenced by no prepossessions in favor of the district, with little hope held out, except by a few who had seen some of the territory, and with full knowledge of the well nigh universal condemnation accorded the country in commercial circles. I would be unjust if I were to convey the impression that I have seen anything that indicates the presence of enormous wealth in the rocks of any locality. But it is not upon such foundation that the prosperity of a region can be based. Prosperity is far more like-

ly to follow the healthy development of lasting investments which yield moderate rewards, and I believe there is room for such in the ores of Cape Breton. To make the best use of what may be in the rocks, however, thorough and systematic study must go hand in hand with investment. This is true of this region as a whole and of undeveloped prospects.

The erratic and unscientific method of much of the search must be held responsible for a fair share of the failure to see any good in the country. A day does not suffice to exhaust the possibilities of a mining district, nor does the sight of two or three localities determine the worth of a prospect. Much will be gained if, instead of the common method, one be employed by the inquirer which shall include a study of the structure, the probable limits of the field in which ore is claimed to occur, and the chances that that particular method of ore formation may be duplicated in kind on the adjacent territory."

So like a geologist. Every one of them a first rate fellow, but when looking for light, from that direction to guide him to a sure thing, one is apt to be left.

By the way, Magnesite, referred to previously, is another mineral which may be included among those whose quality is good and quantity provocative.

IN THE EARLY DAYS.

In the beginning of coal mining in Britain, shafts were shallow and workings of limited extent. Ventilation, it may be said, was allowed to look after itself, natural ventilation, without interference, had its way, and light was furnished by candles, with small illuminating power. The candlestick, as a rule, was a lump of plastic clay, and this plasticity enabled the candle to be stuck in any handy place, a nearby prop or stick of timber. on the side of the coal wall, or even, at times, on the cap of the miner.

The first mention of gas was on or about the year 1550. Mr. A. D. Kays thus describes the first appearance of fire damp: "The unwholesome vapor whereof is so pernicious to the hired laborers, that it would undoubtedly destroy them, if they did not get out of the way as soon as the flame of their lamp becomes blue." The early appearance of these gases, or rather of their effects, was very puzzling to those employees, and such was the want of mining schools in these days that any phenomenon of this kind, which they did not understand, was attributed to goblins, wicked fairies, etc., and other individuals of like nature.

But fire damp was not the first of these noxious gases to make itself troublesome. It must be remembered that there was not the slightest attempt at artificial ventilation, and the very natural

result was that as the workings got more extensive the air got foul with the breathing of men, and the burning of candles. And so we find that choke damp was the first enemy the coal miner had to contend with, and during the whole of the 17th century we find that nearly all collieries were troubled with choke damp, a carbonic acid gas, and to a lesser extent with fire damp. So prevalent did choke damp become in the air of the mines that it was frequently necessary to test the air of the shaft before descending. This was done by lowering a lighted lamp, or candle and if this continued to burn it was taken that the mine was free."

It may be of interest to describe the method adopted to recover a man overcome by choke damp. The instructions to the ambulance man of those days were as follows:

"Dig a hole in the ground and lay the asphyxiated person face down with his mouth in the hole. If he does not recover with this treatment he should be turned over on his back and, to use the exact words: "then fill them full of good ale." It seems highly probable that the number of asphyxiated colliers in a day would be considerable, and they would take care not to recover, until this second method had been applied to its fullest extent. No doubt there was a clause in the instructions stipulating that no collier must get asphyxiated more than three times a day in any one shift, or words to that effect. Probably the first recorded instance of asphyxiation from this cause occurred in 1621.

* * * *

Coal was first mined in the province on the north side of Cow Bay—now called Port Morien—in the year 1720. The product was used in the construction of the fortress of Louisburg. There are still to be seen the remains of the old French working at a spot or two along the shore of the Bay. Several years ago, when the writer along with the late Patrick Nevilles and prospector Pendergast, were

trying to locate the northern outcrop of the seams now being worked at Birch Grove, the men employed pierced through the ground a short distance easterly from Long Beach. The then vacant level or tunnel had been part of a coal seam, a level of some description, as it was not broad but was of some length as a fence post thrust in at an angle, failed to strike anything solid. The conclusion was come to that here had been an old French working, but possibly the conclusion was erroneous. An old miner some time after when told of this incident said, "How do you know your pole did not go into the old water level of the Block House Mine?" When asked if there had been a water level in the mine, he seemed hurt at doubt being cast on his statement.

EARLY COAL MINING IN NOVA SCOTIA.

Richard Brown's famous book, of which the writer issued a reprint in 1899—and which is now out of print—brought down the history of the General Mining Association, the beginners, on an extensive scale of coal mining in the province, to the sinking of the "New Winning" in the middle sixties. Two shafts were sunk circular in form, hoisting shaft 13 ft and pumping shaft 11 ft. in diameter. In 1868 heavy feeders of water were encountered, and sinking ceased during the erection of a heavy pumping engine. In 1870 the sinking was still uncompleted. The output was maintained, at its usual figures, from the old workings principally submarine. There were 11 acres worked under sea on the northern side of Cranberry Head and 22 acres under Lloyds Cove. In 1874—November, the main seam was reached, and found to be six feet thick and of good quality. In 1875 more tubbing was put in the new shafts and they have kept dry since. Over 700 tons of iron were used in the tubbing. It took a dozen years from the beginning of the sinking to get the new colliery rightly under way. The new shafts were the scene of the first serious explosion in Cape Breton. This happened on May 21st, 1878. Six men, including the Manager and Overman were killed. About this time a Guibal fan was erected, the first mechanical ventilator in Cape Breton. There was a serious fire in the workings in 1885

the cause of which was never explained. It was estimated that 74,000,000 gallons of water were used to put out the fire. In 1898, the production of the G. M. A. was 273,904, proof that the Dominion Coal Co., had not injuriously affected outputs.

Mr. R. H. Brown, former manager for the G. M. A. states in a paper read at a meeting of the Nova Scotia Mining Society:

"The Princess pit known as Sydney, No. 1, of the old Sydney Mines was the first colliery in North America to begin the getting of coal from beneath the bed of the Atlantic Ocean. This was in the year 1876." * * * The working of the whole coal under the sea by the bord and pillar system was commenced under an overhead cover of 690 feet of solid measure. Part of the workings driven to the rise under Sydney Harbor. . . . At 5,000 feet from the shore the cover was 1100 ft."

It has been stated near the beginning of this article that during, and therefore presumably prior to the sinking of the shafts, that coal was being taken from under the sea at two places, some distance apart from each other. The shaft at Cranberry Head is still called Princess, so the writer is forced to assume taking Mr. Brown's statement that there was an old as well as a new Princess. This could easily be verified, but it is not an essential point. The real point is that the G. M. A. were the first to do submarine mining.

The details of the operations of the mining of coal on the southern side of Cape Breton County are so succintly related in the Bulletin written by Mr. F. W. Gray and issued by the Ottawa Department of Mines, from whom it may be had on application, that it is unnecessary to refer to them at this point.

PICTOU COUNTY.

It will be impossible in these pages to give other than a bald outline of the beginning and con-

tinuance of coal mining operations in Pictou County. It will be only possible to skip over the ground. The subject is a splendid and tempting one, fruitful alike to the lovers of fact and those who have a liking for fancy. Material is sufficient for the compiling of a large volume. No other County in Nova Scotia can furnish so many adventures in connection with coal mining, at once interesting, startling and thrilling. Lives in other Counties may have been sacrificed in explosions and fires, but Pictou has to its debit victims by flood. It is an old story the mining of coal in Pictou County, dating to 1798. The exact date of the discovery of coal in the County is in dispute. In his history of Pictou County the late Dr. Patterson claims that Dr. McGregor, a Presbyterian Minister, was the first to discover coal in 1798. In 1798, there is no doubt that Dr. McGregor used it as a fuel, and showed it, as something wonderful to the candidates in the first general election in Pictou County. Dr. McGregor, for sure was the first to use gas as an illuminant, and in this case showed it to some of his brethern—on this side of the Atlantic. This was a hundred and more years ago. The gas from the coal mines in the vicinity of his dwelling exuded from the coal below ground. By inserting pipes in the ground Dr. McGregor collected the gas and carried it to his house. As the Doctor had no gasometer and no cocks or valves, he found it impossible to regulate the flow, and so this very economical method of obtaining light had to be abandoned

Long ago, in the winter as well as the summer months the wives of the workmen at the mines did their washing "on" as well as at the river. Mr. F. W. Gray in the Bulletin previously spoken of, quotes Mr. Smith—an early Manager for the General Mining Association—as relating how washing was done in the summer, but as Mr. Smith, probably, did not among his other duties have supervision of the washings of the households, he has om-

itted to mention what the writer considers a far more interesting point, that washing was done on the top of the frozen river in both winter and early spring as well. In summer a hole was dug in the ground on the westerly bank of the river; a match was waved over the hole till the gas issuing was lighted, and this gas kept burning steadily until extinguished. The water pots were hung by means of a hook and a tripod over the burning gas and a regular supply of hot water obtained. In winter time two holes were cut in the ice, one for the gas to light the fire and the second for a soft water supply. Historians have related of the coming of "water gas" but never of this early method of securing it. Just how the washerwomen knew without prospecting, the best place to locate was not explained, but it was asserted that as a rule they had no difficulty in securing a site where sufficient gas issued to keep the pots boiling while the operation of washing lasted.

Though Dr. Patterson gives Dr. McGregor the credit of being the first discoverer of coal in the County, in 1798, it must have been discovered many years previously, as in 1785 reports were common of the occurrence of coal in the County.

There is likewise some difficulty in determining who was the first legally to mine coal. John McKay in 1807 worked a three foot seam of coal on his father's farm. One authority hints that it was worked without lease from the Crown as the first lease for coal was not granted till 1809, when one was granted to Ed. Mortimer. Another account says McKay did receive a license to work coal to sell to the inhabitants—and at a later date to mine coal for export. It is certain that John McKay, in 1815 obtained a license from Sir John Sherbroke. Having no money, he borrowed some $12,000; but he did not seem to make his venture a success, as the lenders, two years later had to buy him out and beg for a renewal of the license. In 1815 there is

mention for the first time of coal having been sent to Halifax; about a thousand tons were sent that year. The coal produced up till 1827 was about 3,000 tons.

In 1827 the General Mining Association came to Pictou Co. It is thought that what went by the name of the Old Store pits, were sunk that year, and finished in 1828. A steam engine, the first erected in Nova Scotia, was in operation at the Albion Mine, December 1828.

From 1824 to 1838 the coal was loaded into scows. A tug boat was launched at Fishers Grant in 1830. In 1834 the building of a railway to what was afterwards known as the Loading Ground was begun.

The first spoken of fires in the Mines was in 1834. The fire was found in several places, too remote to allow of the supposition that they were accidental. An investigation followed and disclosed the fact that the fires were incendiary. The pits had.to be flooded. This was the first of a succession of fires from 1832 up, it may be said, to the present day. Of the history of the Albion Mines, it may be said that it is a history of mine fires and mines lost, or partially so. The amount of coal gotten from the Albion mines since 1834 may be computed; the loss by fires, etc., is beyond computation.

Coal Mining in the early days was not a highly profitable business and some declare it never has been, although the coal operators for the past score of years have often been referred to as Coal Barons. The first coal was sold for about two dollars a ton in order to introduce it. The price at times ranged as high as three dollars. As noticed in a previous chapter the Hon. Mr. Cunard stated in 1850 that in 18 years the G. M. A. had never declared a dividend. It could scarcely be otherwise. Pits enough were lost by fires to place any ordinary company in "difficulties," not to speak of the vast sums spent in

building up only to tear down again. For twelve years the G. M. A. spent $100,000 yearly in development work. For years coal cost to produce about twelve shillings—currency surely—per ton and sold a sixpence less, so there was not very much room for profits. Miners, in the early days, were or ought to have been a happy lot. The wages ran from $1.60 to $2.40 a day. This was probably a higher rate than is paid today—high as present wages are held to be—the simple mode of living in these days taken into consideration. Rents were merely nominal and so also was the price of coal to the workers. In 1865 the Albion Mines did a brisk trade, and shipped in say nine months of that year over 200,000 tons of coal, a larger quantity than was being produced thirty to forty years later.

In the year 1872 a new concern called the Halifax Company acquired all the rights and interests of the General Mining Association.

In 1886 the Halifax Company entered the Amalgamation as it was popularly called at that time. The Amalgamation included the Halifax, Vale, and Acadia. The corporate name of the new company was Acadia Coal Co. On the completion of the Amalgamation H. S. Poole of the old Acadia Company took a position of Agent or General Manager, which he retained until 1900, when he was succeeded by C. J. Coll of Pittsburg, who in his turn was succeeded by Evans. The present General Manager is Hector Prud'homme. The present position of the company is most promising, as within the past three years numerous previously unknown seams were discovered on the areas and are being opened out.

The second Company—the G. M. A. being the first to undertake mining in Pictou County, was the Acadia Coal Co., composed chiefly of Americans. This company was organized through the efforts of the late Mr. J. D. B. Fraser of Pictou The company commenced operations on the Mc-

Gregor seam at the place originally opened by Mr. McGregor. Not much work was done at this point as shortly after the operations started an excellent seam of coal known ever since as the "Acadia" was discovered about two miles west from the McGregor workings. In 1867 the Acadia Colliery was started and three miles of railway built to connect with the railway at Stellarton. The company built wharves at Fisher's Grant—opposite Pictou. The Acadia Colliery worked without interruption for over two score years, and is the one big colliery in Pictou County which never met with a serious disaster. After the main slope had reached a depth where it became unprofitable to mine unless a set quantity could be produced daily, the mine was temporarily abandoned.

Mr. John Campbell who had traced the Acadia seam a mile southerly, from where it was discovered by Mr. French or Mr. Fraser—the honor is in dispute—secured a mile-area, opened a small pit called the Campbell, and subsequently sold the area to certain Montreal capitalists about the year 1867. who formed themselves into the Intercolonial Coal Mining Company. In 1868 two slopes were sunk in the main seam. The work must have been energetically pushed as 14,000 tons were shipped that year. Wharves were built at Granton and were connected with the mine by railway. In 1872 there came a brisk demand for coal and 102,000 tons were shipped. About noon of May 13, 1873 a terrific explosion occurred, resulting in the loss of 58 or 59 lives. The discrepancy of one is possibly due to the belief that a volunteer carpenter is not included among the list of those who were beneficiaries of the Relief Fund.

The Vale Coal and Iron Mfg. Company started to clear land for the sinking of a slope in 1872, in 1874 the output was 39,000 tons. In 1886 the Vale produced 121,000 tons. In that year the company entered the Amalgamation. In 1889 the McBean

pit took fire, was flooded and remained in that condition till 1918, when unwatering began. After several years the six foot seam was opened and worked for a few years. It is now in 1918 about being reentered. The N. S. Steel and Coal Company opened a colliery near the Vale which went by the name of the Marsh Colliery. The Mine was operated for a number of years and then abandoned, as coal could be bought elsewhere more cheaply.

In Mr. Gray's paper issued by the Geological Survey or rather Mines Branch of the Ottawa Department of Mines, the writer of this is of opinion that a typographical error makes Mr. Gray say that coal was unearthed in Westville in 1854 and the Black Diamond Co., started. Black Diamond was the name of the Colliery. Nova Scotia was the name of the company. The year the coal was "unearthed" must have been 1864. In 1869 when the Acadia and the Drummond had each reached an output of over 7,000 tons, the Black Diamond was still a non producer, only in 1871 had it connection by rail to a shipping place on the Middle River, and cut no figure as a shipper until 1873, when 80,000 tons were exported, and that was the best year's work the Company ever did.

In the early days of Mining not only in Pictou County, but in other parts, the miners were content to take fewer off days than they have been in the habit of doing since the coal trade started, that is, idle days on their own account, though in the eighties and previously the pits were frequently idle owing to the number of holy days or saints days that were celebrated. These interfered seriously with shipments, which of course, could be made only in the season of navigation. The off days were a serious loss say in 1882-83, on account of the heavy demurrage if vessels were not loaded in a given time. The Secretary of the Glace Bay Mining Company wrote the Grand Secy., of the P. W. A. asking what could be done in the matter. The

latter suggested that the Secretary of the Coal Company should invoke the cooperation of the clergymen, telling them that commemoration days were abused, and offering to collect Church dues through the office in return for their intervention. Mr. Lithgow did this, and the outcome was that from that time Church dues were collected in very many cases in the pay offices.

The miners in the province so long as payments were monthly and payment was made on the yardage and not the tonnage, or by part tonnage—or by box—and part yardage, had or took a day and a half or so only, regularly each month. The half or three quarter day was on measuring, and the whole day was on pay days. This arrangement or understanding was more acceptable to the operators than a day off now and again as it suited the workers' fancy. The operators did not expect the men to appear in full force, if at all, on these days. So if a number did not show up there was no disappointment and little disarrangement.

There is little wonder if in the early days of mining in Pictou there were fires and minor explosions. All the pits were very gassy and its constant presence bred that contempt which accompanies familiarity. The gas came hissing through the solid coal. Sometimes it caught fire accidentally from a miner's lamp, and on occasions it was set on fire by miners or driver lads, desirous of obtaining a lesson in chemistry, or of satisfying a devilish curiosity.

To light the gas was extremely easy, but at times it was very difficult to put it out. The usual fire apparatus consisted of Miners' coats. If these failed, then calls were made for the cannon which was kept in an accessible place in the mine. The discharge and the concussion had generally the effect of extinguishing the flame. Old miners have described to the writer that the cannon was used most frequently in bench shots which did not do

their work and had set the coal on fire at the back of the shot, where the fire could not be got at. The cannon then became serviceable. The nozzle was long and of small bore, small enough to enter the front of the shot hole. When in position the cannon was fired and was as a rule, successful. When it failed to work, then as many hands as there was room for, set to work to loosen the coal in the bench and expose the fires. There was difficulty in maintaining the roadways on account of swellings or upheavals. There were those who said the great pressure was responsible for this. Others said it was due to the pavement becoming inflated with gas. Probably it was due to both causes.

All of the pits from the beginning of mining till the present time may be placed in the very gassy class and therefore it may not be surprising that pit after pit has been lost and abandoned. The loss of so many pits and consequently of so much coal was drawn attention to in the legislature with the result that in 1895 a commission of four experts, including the Inspector and Deputy Inspector for Pictou County, was appointed to enquire into the Cause, History and Effects of fires in Pictou Coal Mines. That was nominally what the Commission was appointed to do, but its real object, and that aimed for was to find out if there was possibility of recovering some of the vast quantity of coal remaining in the "lost" mines. The commission did not receive that assistance from the then management of the Acadia Coal Co., that might reasonably have been expected. It looked as if the management was averse to any evidence that would sustain the belief that there was an immense quantity of coal in the old pits, and possible of recovery. It cannot be said that the evidence nor the finding based therein were satisfactory.

The Report has this to say in reference to the amount of coal in the old workings.

"It may be remarked here that from calculations

of a general nature it would appear that there is in the bottom coal of the Burnt, Big and Foord pit workings, and in the pillars in the upper part of the same seam—all in the main seam, 10,000,000 tons of coal." The main finding of the Commission reads:

"It appears evident, however, that neither now or at any future time will it be feasible to mine the coal in the abandoned working of the Main seam, unless steps are taken to extinguish all crop fires and to prevent recurrence of spontaneous fires in the deeper sections by admission of air, or relighting of any fires that may have been burned down from the crop. If no attention be paid to the workings at present carried on in the Albion area, or if they were for any reason abandoned, the immediate filling of the workings with water would be recognized as the only method of preserving the coal for future use."

Which amounts to the verdict that no attempt can be made to recover any coal that may remain in the old workings, until it is impossible to get coal anywhere else in the district.

INVERNESS COUNTY.

How much longer time than half a century has elapsed since coal was first mined, for shipment, in this county it is nigh impossible to determine. In the middle of last century coal was shipped from at least two points, from Chimney Corner, and from Broad Cove. The former is given the credit for being the first to ship in sailing vessels, but that point may be open to debate. If Chimney Corner shipped prior to 1864, then the same accomplishment is claimed for Broad Cove, now known as Inverness town. Previous to 1864 coal had been shipped, so old reports say, from the "River," but of these shipments there are no authentic records. In 1865 some fifty tons were shipped by Blackwood and McCully. Whether other shipments were made cannot be ascertained. The coal was taken by tramway to the

beaeh, loaded into seows and then transferred to the vessels lying off shore. In or about that year efforts were made to organize an English Company to work the mine and make a harbor of "MeIsaae's Pond," but these were unsueeessful probably on aeeount of the laek of reliable information as to the extent of the eoal field in the vicinity. At that time it was thought that the area containing coal was limited, eonsisting of little over a square mile or possibly two, instead of, as now known, many miles both landward and seaward. In those days the mining of submarine coal was not looked upon as feasible. After the eompletion of the Inverness Railway it was thought the McKenzie and Mann interests had in view extended plans for opening several, and not one mine only.

In 1918 development work was being eonducted at St. Rose at a point, where bore holes, proving the existence of eoal, had been put down several years ago. St. Rose, following the shore road, is about equi distant between the town of Inverness and Chimney Corner. The eoal obtained from the development work found a ready sale in the loeality. Large development work, or produetion ean neither be looked for at St. Rose or Chimney Corner—where some development work was also being done--until both have connection with the Inverness Railway, or with the Canadian Government Railway, or with a new railway eonneeting with a shipping port near the oeean entranee to the Straits of Canso.

The writer has long spoken favorably of the excellent possibilities presented by Inverness, in the way of mineral development and produetion. He has referred to these on several oeeasions in artieles whieh have met with approval and were given space to, in parts, in governmental reports.

In the Report on Subsidized Railways, Dr. Murphy, who was Provincial Engineer for many years, made, in 1891, a new departure by embodying in his report the possible sourees from which at

least one of the new railways—the Inverness and Richmond—might derive large traffic. The following is taken from Dr. Murphy's report for 1900: "Following the 80 miles of coast line from Hastings to Cheticamp, about 37 miles—or nearly half the distance, according to Mr. Fletcher's geological survey,—cross the true coal measures in belts intervening with their associated rocks. In some cases they cover a mere strip along the shore, in others they extend well up into the valleys. The coal mining areas at Broad Cove, Port Hood, and at Chimney Corner, are instances of having greater extension inland. Proceeding along the shore these deposits are met with in the following order:—

Hastings to Craignish, 8 miles, Devonian.

Craignish to Long Point, 4 miles, Metamorphic.

Long Pt. to Judique Riv., 13 miles, L. Carboniferous.

Judique River to Port Hood and to Mabou, 6 miles, Coal Measures.

Mabou to Coal Mine Pt., 6 miles, L. Carboniferous.

C. M. Point to McPhees, 2 miles, Coal Measures.

McPhee's to Port Ban, 2 miles, Pre Cambrian.

Port Ban to B. C. Chapel, 6 miles, Coal Measures.

Chapel Riv. to Marsh Pt., 4 miles, L. Carboniferous.

Marsh Pt. to Margaree, 11½ miles. Coal Measures

Margaree to Gr. Etang, 8½ miles, Coal Measures.

Gr. Etang to Cheticamp, 3½ miles, L. Carboniferous.

Cheticamp Island, 3½ miles, Coal Measures.

Coal has been known to exist in workable quantities along the coast of Northern Inverness long before that part of Cape Breton was known of as Inverness. The first settlers could pick it from the cliffs and utilize it for their domestic wants. The products of all the coal mines in Cape Breton ten years ago (1880) did not reach a million tons; prices were low; sales difficult and any efforts made to-

wards advancement were ineffective and irritating. Now that the products have reached over two and a half million tons per annum (1890), and are likely to go at no distant date a million better, not including what Inverness may contribute, things have assumed a more favourable aspect. The conditions have entirely changed; there was more fuss in shipping the million tons than the two and a quarter million tons last year. Sales are easily affected and on much more advantageous terms, whilst prices for mining properties have gone up with a rush, and lead to the influx of capital which is is our chief industrial need. (The writer does not wholly agree with that oft repeated statement. What are most needed, in his opinion, are courage and skill and unassailable probity. There is "loads" of capital, but in the past it has been so,—well not to be too blunt let it be said—unwisely directed that many hesitated to venture on new undertakings.) The whole system has been recast. The remarkable success attending the Dominion Coal Co.'s operation and growth has given birth and encouragement to kindred enterprises. The establishment of the Dominion Iron and Steel works at Sydney is chiefly, if not entirely attributable to it. The prospects arising from the success of these industries in Cape Breton County, lend influence and inspiration to similar organizations in the County of Inverness. . .

. One must feel convinced that there is a bright prospect for successful operation in the working and development of collieries in the northern as well as in the more southern districts of Cape Breton."

There was remarkable activity, prompted from some cause unknown, to any authority of the present day, in taking out licenses to work and Rights of Search in the years 1863 and 1864. In these two years there were eight of the former and over two dozen of the latter applied and paid for. In these same years there was a similar furore in Cape Breton County and to a lesser extent in Cumberland County. After that, applications for rights were few

until after the coming of the Dominion Coal Company, when the business had another spurt. On this occasion a majority of the applications were for submarine areas. In and around 1863 operations in Inverness County were confined to the mine at Port Hood, operated by the Cape Breton Coal Mining Co. Work at the Chimney Corner mine had been suspended.

* * * *

Referring to the unwonted activity in applications for licenses and rights, the Chief Commissioner of Mines in his report for the year 1864 says:—

"The increased and increasing interest taken in mining enterprise is shown by the fact that during the three quarters ending Sept. 30th, 1864, there were made and paid for no less than two hundred and forty-seven applications for Licenses to Search, and thirteen for licenses to work, a total of two hundred and sixty in all. As these licenses to search rarely cover an area of less extent than five square miles, it thus appears that within the same period applications have been received covering, in the aggregate, a tract of no less than one thousand two hundred and twenty-five square miles. The greater part of these were taken with a view of searching for coal, but several were for copper, lead and other minerals."

CAPE BRETON COUNTY.

The following items showing what was being done in the coal mines in 1864, taken from the Commissioner's Report, may be of interest, as the Reports for that and many following years are long out of print:—

Mira Bay Mines—In northern shore of the Bay of same name. Some coal has been shipped since the 30th of Sept last, none had been shipped before that. Coal 4.6 to 4.9 inches in thickness. 23 men and 3 horses employed on the premises. Prospects good.

Caledonia Mines—In the possession of Wilson

and others, on the promontory separating Cow Bay from Mira Bay. A wharf has been constructed extending 120 feet on Cow Bay. 15 men, 4 boys and 2 horses.

Gowrie Mines—"Messrs. Archibald, North Side of Cow Bay. In nine months, $13,200 expended on wharf and breakwater, $5,000 on machinery, $500 in sinking a new pit 85 feet in depth" (astonishingly cheap shaft sinking in these days) "$6,000 in the construction of a railway between new shaft and shipping place."

Block House, Cow Bay—The product for the year will quadruple that of 1863. (The products or rather sales for nine months were 45,000 tons. Employees 557 men and boys, and 40 horses, (a fairly large force for say fifty to sixty thousand tons a year, but possibly very many were employed at construction work.) 60 buildings, including miners houses have been erected. Models of their kind. Coals were being raised from the mine at the rate of 400 to 450 tons a day.

Schooner Pond—Moderate business, 55 men and boys, 5 horses. Expenditure in development work $5,400.

Clyde Mines, Big Glace Bay—40 men and boys. Expenditure $13,500.

Little Glace Bay Mine—As a producer ranked next to Sydney Mines, if they have not exceeded them last twelve months. Artificial harbor still further extended; two piers 450 ft. long each; harbor and channel excavated to 17 feet below low water. Harbor was a small rivulet, where harbor now is, mostly dry at low water in the bay outside. Approximate cost of harbor $80,000; 29 dwelling houses; 65 tenements, average men employed, 282; operations began in 1864, on the Parrot area assigned to the Company.

Converso Area—No shipments, but $7,400 expended.

International Coal Co.—Considerable activity in moving and shipping coal. Company has acquired 4

square miles. Planning to build a railway, some fine miners' houses built. Expenditure $14,300.

Boston and Bridgeport—South side Bridgeport Basin. Reported discovered seams of good workable coal. No shipments. Expenditure $7,900.

Lingan—General Mining Association. Men employed, 165.

Sydney Mines—Same company, 500 men employed, 103 horses. (The references to the "Collins, the Roach" the Campbell at the Bras d'Ors are uninteresting.)

The International and Block House both engaged in making surveys for railway lines to connect collieries with good shipping ports.

New Campbelton—Big Bras d'Or, 120 men and boys, 18 horses. Expenditure of $10,440 in nine months.

RICHMOND COUNTY.

No shipments from this County. Forty-eight men employed.

Cumberland County—reference is made to the following mines "Joggins," "Victoria" and the "Lawrence Company," "River Hebert," "Maccan Mine," "Maccan and Chignecto" near the Maccan River."

Between them in 9 months of 1864 they shipped about 15,000 tons of coal. These figures represent the total for Cumberland County for 1863."

CUMBERLAND COUNTY.

Third in order of age.—Though coal had been produced in this County from 1847, and pirated for years before that, in exposed places, the production did not add much to the total of the province until a few years following the operations of the Springhill Mining Company of which it may be said that from its start it made its coming felt. From say 1873 Cumberland County made a substantial addition to the provincial coal shipments and since that time it has run a close race with Pictou County, and

has indeed, on occasions, outdistanced it. In 1887 the production of the Springhill Mines had run up to 466,000 tons, and of course the production from these mines constituted by far the largest share of the total from the county.

Until say three or four years ago, the oldest mines—the Joggins, was never placed among the larger producers. Since 1900 the output of the Springhill collieries has never reached the 1887 maximum, whereas the Joggins has kept creeping up, increasing its output from 48,000 tons in 1880 to 200,000, or over, during the regime of the present management. The Joggins until a few years ago was never a financial success, and there were reasons, and it is doubtful if any other mine in the province has been subject to so many changes alike in its proprietors and its management. To relate happenings in its history would no doubt be interesting, but those would require almost a volume by themselves.

The "Joggins Mines" was opened in 1847. The opening was in a sense compulsory being due to the strong representations and demands made to the Local Government, to the effect that people were suffering from the want of coal. The General Mining Association, who were forced to operate—being holders of the lease, lost much money in the undertaking, so their agent declared. He alleged that they spent a hundred and ten thousand dollars in the operating of the mine, and all the return received was $45,000. He further affirmed that the annual coal consumption of the district was only 100 chaldrons—150 tons. The Association, when assailed, at a later period, declared they could easily have supplied all demands, and very much more, without having been compelled to open a colliery at the Joggins. In view of the late success of the Joggins, it is fitting to state that the active director was Hance Logan, ex-M. P., while R. J. Bell is General Manager.

In the addenda to his reprint of Brown's book

on the "Coal field of Cape Breton," the writer said:—

In the year 1865 the anticipation of the railway from Truro to Moncton led to prospecting in the Springhill district. In 1867 the Black or eleven feet seam was discovered.

On what authority he based this remark, unless he was Dr. Gilpin of the Mines Department, he cannot remember. He is now inclined to the belief, an assertion made by the first miners at Springhill that coal was first discovered in the Springhill district by John Anderson in 1868. Several pits were operated by him in the woods in a small way for two or three years. Anderson was a burly, brusque Scotsman and had considerable push about him. Both statements may be accepted as correct, if the qualification be made that Anderson discovered coal in 1868 in the Springhill "proper" district. Towards the end of 1871 three square miles were acquired by lease from the government and in 1872 a company, consisting chiefly of St. John business men was formed to operate the areas. In that year a branch line of railway was begun between the Junction and the Mines. Regular operations began in the East and West slopes in 1873, and preliminary steps taken for the construction of the Springhill and Parrsboro Railway. In 1871 the General Mining Association sold the Joggins tract to the Joggins Coal Mining Company and the Joggins Coal Mining Association. The pit called Hardscrable, well worthy of the name, was opened by the former, but as the seam was only two feet thick it never was profitable and had a short life. The coal boom of 1873 stimulated the opening of numerous mines in the county, many of them by American capitalists. In its earlier years the Springhill Mining Company made big dividends so large that they were emboldened to buy in 1879, from the G. M. A. the four square miles held by them in the district and which had hindered the desired extension of the Springhill Mining Company's operations. It is said the price paid was £60,000, the G.

M. A. to have the appointment of a member of the Board. It is further asserted that dividends ranged from 16 to 21 per cent., the highest ever paid by a coal company. The company succeeding would have been happy with six per cent. In 1884 the rights of the Springhill Company were transferred to Montreal capitalists who assumed the name of the Cumberland Railway and Coal Company.

ROMANCE IN PROSPECTING AND FANCIFUL FINDINGS OF COAL.

The writer was asked some years ago to give all information possible regarding the kind of surface that is generally looked for when coal is sought for, and also the characteristics of the soil and rocks, and if soil is good for cultivation, or is under brackens, wild shrubs and the like. In short, the questioners wanted to know what were the best surface indications to guide one in search of coal. The only possible correct reply was: There is no royal road no definite rule which one may follow in prospecting for coal, though it is necessary to know if he is at or in the Carboniferous Measures. The surface gives little indication indeed, unless one is lucky enough to encounter fossils of ferns, or other plants, or lands upon a surface outcrop. Coal may underlie barrens, as in several counties, or it may be covered with wood of various kinds. Some have prospected for coal in vain, simply because the lay of the land in some particular locality was similar to that in which coal was being mined. Later an instance of this kind will be furnished.

The late Patrick Neville, who was accounted as good a coal prospector as C.B. has produced, declared there was coal wherever a certain kind of small rootlet could be found, immediately below the surface. There were at least two unbelievers in this mode of getting information, one of them a brother Deputy

Mine Inspector. The two challenged Mr. Neville to a test. The ground selected was between the old Richmond Mine, in Richmond County, on to nigh Point Tupper. A shaft at that time was being sunk at Caribou Cove and black rocks being hoisted in lieu of the real article. (The two doubters knew that coal could be found at many points in Richmond County.) The three walked for miles and were getting body weary, though their vocal organs did not betray them, for they kept, at very short intermissions, asking Neville to come on with his rootlets, as surely there must be coal near. He poked the ground intermittedly and at length exclaimed: "Here you are, there is coal underneath." The two gazed at the rootlets, very small affairs as fine as human hair. A pick and shovel were brought into use, and, sure enough coal was struck. All were aware of the characteristics of the Richmond measures—broken in every imaginable direction, so one insisted that a hole should be dug on the other side of the road in the direction the coal ought to follow—or should dip, but no coal was there. There was no further prospecting; the remainder of the time was spent in discussing the point whether similar rootlets could not be found on top of ground where no coal lay underneath.

It certainly would be interesting to know how many of the coal seams already known to exist and those now being worked were accidentally discovered or, say stumbled upon, how many were the result of desultory and how many that of systematic persistent prospecting guided by the hints or the knowledge conveyed by geologists. Some seams no doubt have been stumbled upon, or found, when not sought for, and some have been revealed by those who had nothing to prompt them but their hopes. In Cape Breton Island the outcrops of many seams were visible to any passers by; but in the case of the seams inland the discoveries must be credited to a more or less systematic search. The late finds on the areas at Stellarton cannot well be called acciden-

tal discoveries. Mr. Notebeart does not claim that the finds were the result of blind search, or a mere gamble. He worked on the suggestion thrown out that there was the possibility of underlying seams, though no deeper seams than those being worked were anywhere indicated on the surface. The new discoveries, as we stated on a former occasion, were not lucky finds, but the rewards of plucky determination to find out what was below. We would place the discovery of the third seam (Albion Mine) in the category of lucky finds, though it was not found till sought for. The story of the finding is very simple yet interesting. After the big explosion which put not only the Foord but the Cage pit out of commission, the then only available sources of supply, the order was given to the late John Douglas, father of J. C. Douglas, M. P., by the general manager, to go out and find a coal seam. The relation of its discovery as given by Mr. Douglas, before the Commission on Finds in Pictou County, is as follows:—

"We started to explore after that (that is after attempts to recover the Cage pit had been abandoned, etc.) for coal; previous to that the third seam was not known and we looked around for coal and we dropped on the third seam. By Mr. Poole's permission we got 5,000 tons off his area (the area of the old Acadia Coal Co.) until we got opened out on the third seam on our own area. The third seam varies. We got it first near the Cage pit 7 feet 9 inches. * * * I was acting under Mr. Rutherford; he told me to explore for coal and I went to work. I did not know that the third seam was in existence; we had gone up the brook and saw some burnt material alongside there, and we considered that there must be coal not far off; before noon I saw six foot of coal. Next morning Mr. Poole came to me and said he thought it was a 2½ foot seam and it turned out 7 feet 9 inches. When it was found that it was of value the plant was shifted west."

From the above evidence it is clear that the third

seam was stumbled upon, as the chief explorer when he went searching for coal had no definite plans in view. It is said that when the Intercolonial Coal Co., gathers a little money, if it should be fortunate enough to do so, that instructions will be given to bore for coal from a point well to the deep in the present workings. Should a seam or seams be found under the Drummond main seam will it be right to speak of the discovery as a lucky find, seeing it is not wholly a haphazard undertaking, but is based on the fact that the boring in Stellarton was attended with excellent results, and the possibility that just as boring there was attended with unexpected success similar success may attend boring at the Drummond? It is more than a gambler's chance. No one is bold enough to say where shall be found the bottom of the basin seam.

In 1878 glowing accounts appeared in the press of the finding of a seam of anthracite coal in Cape Breton. There had been many reports of findings previously, and, at intervals reports of findings since, and though the discovery in 1878 was declared by a prominent official of the Mines Department, and a big coal mine official, to be the genuine article, there were a few who kept cool, determined to wait and see. With these believing rested on seeing wholly. Their caution was commendable. The find did in some respects resemble anthracite. It had a fine black lustre, was lumpy and not flaky like shales and yet after all it may have been a kind of black shale which contains a large quantity of volatile matter, and leaves as much ash as ordinary oil shales. As yet Nova Scotia can lay no claim to have anthracite classed among her minerals.

It is hard at times to trace seams known to exist. Take for instance the case of the Black Diamond Colliery at Westville. It is on the same seam as the Drummond Colliery and the Acadia Colliery. To get the outcrop less than a half mile northerly one would think no hard undertaking, and yet it baffled one or two well known prospectors for quite a while. It

is a debateable point who first discovered the outcrop of the Black Diamond. Some declare that he was a Pictou County man; others declare that he was an American named French. Fifty years ago each had his champions. This much can be said for the American that in the early days of the Black Diamond, the slope of the mine was, as a rule, called the French slope.

The salient point in the following narrative, that is the point relating to the discovery of coal, may appear very ridiculous, and yet it is an incident out of the writer's many curious experiences.

Early in 1901 announcement was made in the public press that a coal company was in course of formation which might prove a rival to the Dominion Coal Co. Some of the areas spoken of as included in the deal, were known to the writer, and it may not be uninteresting, or lack diversion, to relate how the discovery of coal in these came about.

Sometime in the eighties a miner, a native of Cape Breton county, dropped into the writer's office and asked if there ever had been prospecting for coal on the south side of Grand Lake, C. B., and if any areas had been "covered" in that locality. He said he was anxious to know as a relative of his had written him announcing a discovery. The information sought for was, in due course, obtained and was to the effect that the ground was vacant. The government having granted permission a deputy Inspector of Mines accompanied the writer to the house of the relative of the miner aforesaid. The father, who was to be the pioneer, was, to their regret, absent, but on telling the son the nature of their business, and showing their credentials, they were relieved by his saying: "Oh I can show you what you are after." The time was midsummer, and the day was hot for a trudge over the moor. The path, evidently, had seldom been traversed by human foot. As they trudged along they came to the conclusion that they were surely pasing over measures, as at a point they picked up some fine

fern fossils peculiar to coal fields. It was hinted to the guide that it was unecessary to go further, and one of the party made a motion to take off his coat preparatory to digging, when the guide interrupted and said: "Oh no, this is not the place, come further along" and they went along. After a further trudge the coal measures were left behind and their patience was becoming exhausted. By and bye the guide cried "Halt," adding, "Here we are." The writer ejaculated "Where?" and the mines official knit his brows, amazed at the man. Both fell on him metephorically of course, and demanded why they had been brought to this outlandish spot, when they had passed over far more promising ground. Then solemnly the guide related his story in the following fashion: "While up on the hill over there, looking for strayed cattle, my sister heard the clicking of picks, the tapping of drills, the hiss of escaping steam, the thud of hammers and the whistle of a locomotive."

"Yes?"

"And of course that means that there is coal about here."

"Well I'll be blowed," was the expression of one as he bowed his head like one who had lost something he knew not what. What the other said, thinking over it from this distance of time, may be termed refractory rather than refined. Retracing their steps to the place where they had found the fossils, a spot was selected, a hole dug, and, surprising to relate, coal was struck, two or three feet from the surface. The visitors and the guide as well, were pleased. One of the two wished to start for Halifax at once in order to secure Rights of Search covering the ground. The other persuaded him not to be in so much of a hurry, until by further digging the thickness of the coal could be ascertained. This work was to be done secretly in a day or two. After a delay of some three weeks the suggestion was again offered that the area be covered at once. The reply to this was a call for patience until further exploration

was made as the seam might turn out to be three feet thick only, and that was no great catch. There was more delay resulting in a loss of all patience. The one who had at the first favored action proceeded to Halifax to take out search areas. On examining the map in the mines office, he was more than astonished, amazed, to discover that there was not a spot in any part of the district in which a pin point could be inserted without encroaching upon ground already covered by several mining men who had for long prospected in the neighborhood without success. The secret of the find had in some way got out, but not the whole secret, for to make sure that they had covered the spot, where the find was made, the men referred to had not only covered five miles but five times five, a thing the like of which had never occurred previously, on one day, in the history of Rights of Search in the province. How the trick was done will ever now remain a mystery. Some one had made an indiscreet remark. The one philosophic reflection is that everything is, almost, fair in love and war, and the securing of mineral rights. One of those who had secured the areas was the General Manager of the S. & L. Coal and Ry. Coy. Meeting him in Halifax shortly after the areas had been covered the writer said to him: "That covering of areas was slickly done." "Why," said he, "I told them if there was any 'shinanigin' about the business, I would have nothing to do with it," and in justice to the gentleman it should be told that he added: "If you have been dealt unfairly with I will make a place for you among the others." He was thanked, but the offer was refused in these words: "By no means. Had I been in their place there might have been the temptation to do what they did." The fault was ours.

The following incident, having more of pathos than of pleasantry in it, is another of the writer's experiences. A party from East Pictou called upon him and asked if he would go down to a place a

few miles from Whycocomagh and examine work that had been done in a search for coal. He consented, again accompanied by an official of the Mines Department. On arriving on the ground the father of the man who had made the request to visit the place, met and accompanied us to the spot to show the work that had been done. A tunnel, of considerable length, had been driven into the hill side through solid, hard rock. The work must have been arduous as the appliances were primitive. The tunnel was examined and the question put: "What in the world tempted you to select this spot as a possible place where coal might be struck?" The reply gravely made was: "My son is a coal miner in Pictou County and he told me the country there looked similar in many respects to that on my farm, and advised me to search for coal." He further added that he wanted to know if there was any likelihood of finding coal as his means were exhausted and that he had been even forced to borrow on the security of his farm. Pretense, in order to gain time for an appropriate answer, was made of a second examination of the tunnel and after that the mines official, travelled up and over the other side of the hill. On his coming back he was cornered by the writer and asked, "How does it look on the other side?" "Why," was the reply, "it looks as if there might be iron ore knocking around." They stood discussing for a little who was to communicate their findings to the farmer. The one replied point blank that he would not and the other as pointedly said he would not adding he wished there was a clergyman within hail. Finally they composed a speech which consisted in the advice to discontinue prospecting for the present, as the probability was that there was quite as much likelihood for good money to be made in farming as in coal mining at a place remote from either water or rail facilities for shipment. This attempt at subtlety did not go down with the old gentleman. He guessed that he could banish the hope of finding coal and his face gave in-

dication that his heart was heavy, and so were ours, as we realized what the verdict meant for him.

The foregoing was a case of jumping to a hope, or conclusion without the slightest warrant; and it is to be feared that very much of the prospecting done has been of a similar nature.

* * * *

Sometime previous to 1893 certain parties took up a Right of Search over territory the right over which had been allowed to expire. The area covered by them had for a considerable time been held by one whose name was familiar to the folk at Cow Bay—now called Port Morien. The ground was immediately looked over carefully and under directions of one of them who was a noted prospector, a spot was selected where search should begin. This was an excellent selection. After sinking a short distance coal was struck, the thickness being eight feet. One of the party whose experience was varied, if not very extensive, proposed that no more sinking should be done; that with a clear conscience the holders could offer for sale the property with the announcement: "Here we show coal of a thickness of eight feet; we know nothing of its extent, our rights cover a mile; we are willing to sell at a reasonable price on what the trial pit has demonstrated." The proposal was met with this amendment, "Oh no, no, let further exploration be made and then we shall be in a position to demand a much better price. The amendment, the writer is sorry to say, carried. A second pit was sunk, and the coal was found to measure five feet. Then, of course, the decision was to sink another. The third pit was sunk and the coal had—thinned to two feet only. What next? Any more sinkings? "No," was the answer, "let us cover up No. 2 and 3 pits and sell on No. 1" This did not find favor. The objector to the sinking of the second pit said: "We now know that we have but a corner of coal, and it would be wholly dishonest to make believe that the whole of the coal in the corner was eight feet thick the while we knew

positively it was nothing of the kind. In this also, but luckily, the amendment earried.

In the early nineties there were persistent reports that several seams of eoal had been found in Antigonish County. The thiekness of these reported finds was 5.7 and 10 ft. respectively. The rumors and reports were so persistent, eoupled with the faet that the finding of these seams was assoeiated with the name of the diseoverer of the MeBean seam of eoal at Thorburn, formerly named the Vale, that a party who owned an area in another part of the eounty thought it well to seeure definite information, so that the truth or falsity of the various reports might be demonstrated, or established. An expert in coal matters was asked to go to Antigonish, and ascertain what amount of relianee might safely be placed on the several reports. On arriving in Antigonish town he sought for and found one of the men who had been employed on the prospecting party. He asked the man if he eould show him the plaee where the five foot seam had been found. The answer was he eould, and, further, that he would do so willingly. Securing a buggy they proeeeded to the spot equipped with a piek and shovel. When elose to the place, the prospeetor suddenly exclaimed, and the words are given as repeated by the expert: "Oh gosh it is not five feet of eoal but ten feet." Sure enough a short distanee before them was a face of eoal which measured at least ten feet. The prospector was elated, while the expert only gave a feeble smile. The expert said to the prospector: "Show me your pick for a minute." He took the piek, deseended from the buggy, approaehed the eoal faee, struek three hearty blows, and piereed it through. The thickness of that seam was only a few inches. How was three inches magnified into ten feet? Very simply. This miniature seam lay at a very high angle. Heavy rains had washed away the soil and exposed five feet of eoal in length and breadth but not in thickness. A tree further up, had been dislodged and slid down the hill bringing the

earth with it, and exposing more of the face, so that a novice might well exclaim, "Oh gosh ten feet of coal." The thinness of the seam relegated it to the class named "unworkable." Since that time until recently (fall of 1917) no coal seams have been reported as found in that county. The one being opened up at this time (1918) may turn out a seam of good coal but that has yet to be demonstrated. The coal found in the sinkings will burn, and is saleable, whether it will improve so as to be of value, when the coal famine is over, is also a point yet to be determined.

That prospectors are greatly addicted to romance, goes without the saying. Some may be inclined to use a harsher term in regard to many of their solemn declarations. They have an insidious manner of speech, and a way of relation so that they are able to deceive even the elect, the elect in this instance being the members of the government's geological and surveying staff. At any rate the following is gleaned from what may be termed official reports. As those responsible for the short narrative are not now in the flesh, there can be no rejoinder to any criticism. They certainly were "taken in." Mr. Campbell has frequently been quoted as an authority, but the seams he alleged to have found were surely myth, unless indeed the qualification in the closing sentence may be looked upon as an acquittal.

"At Hallowell Grant, north of Antigonish town, several coal seams have been discovered in the basal carboniferous beds. The shales near the coal are of the nature of cannel, and are about twentyfive feet thick. They underlie five or six square miles of carboniferous limestone at Big Marsh. The cannel is rich in oil. There is a small seam of coal, a foot thick, on the west shore of Pomquet harbor, and indications are sufficient to warrant much greater interest than has yet been shown in the coal bearing measures of Antigonish. A seam of coal was discovered some years ago at Big Marsh. This is certainly a promising field for investigation. There is a

limited and probably a productive coal field in the vicinity of South Lake Brook, extending north easterly to Malignant Cove. On the South side of this area the measures dip northerly from 30 to 40 degrees, and are under laid on the south by the Lower Carboniferous limestone and shales. About sixty years ago Mr. John Campbell—hear him—reported five beds of coal there as follows:—

Coal ... .2 ft. 0 in.
Shale ... .3 ft. 0 in.
Coal ... .6 ft. 0 in.
Measures unknown
... ...150 ft. 0 in.
Coal ... .9 ft. 5 in.
Measures unknown
... ...230 ft. 0 in.

Coal ... ...3 ft. 6
Measures unknown ——
Coal ... .4 to 6 ft.
Measures unknown ——
Coal ... ...4 ft.

This gives a total of 30 ft. of coal.

"The precise quality of the coal was not ascertained, but, specimens resembled Richmond coal, or the lower beds in Pictou County." All the criticism the writer makes on the concluding words is that it must be a "two faced" coal.

* * * *

Inverness County has had romances and has witnessed many strange things in connection with attempts to establish a coal industry. To the visitor to the village of Inverness, formerly known as Broad Cove, a score or more years ago, possibly the most prominent, and certainly the most pathetic, object to wrest his attention was the dredge William Penn Hussey stranded at the entrance of McIsaac's Pond, or at the mouth of the very harbour it was intended she should dredge out, and make of it the biggest and the best harbour on all of the northern side of Cape Breton Island.

Her scows were stranded with her and it looked as if the fate of the lot would be their utter engulfment in the shifting sands. William Penn Hussy, after whom the dredge was named, was a splendid actor. Almost every motion he made was for effect. When the dredge was sailing away from

Boston, under tow, Hussey stood on the dock, a rather striking figure. As the dredge moved away slowly he waved his hands, in a majestic manner, and with full throat shouted, "Good-bye; take eare of her boys, she is all I have." When he wanted to impress a party of foreign visitors, or say sharcholders from Switzerland or thereabouts, it is declared he caused the big fifteen-foot seam, which at the outcrop lay at an easy angle, to be stripped of the then overlying strata. When the visitors were in line, under escort of Hussey they were conducted to the clearing there to have practical demonstration that there was coal, and "some" coal at that. Where the leader went they went, and that was on and "over the top," the top consisting of many yards of coal seam exposed.

A tramway two miles say in length was built from the pit to the pond, the site of the proposed new harbour, for at that time coal had, of necessity, to be shipped by water, there being no rail communication. Many a small schooner was loaded there. The mode of working the mine was very primitive, and as costs all round were high, little or no profit was made, if, indeed, there was not loss. On this account it is assumed—an assumption only—the prospect collapsed. That is not to say the promoter collapsed. He had some little compensation while he sojourned at Broad Cove—if the shareholders had none. He was no "We, We Cork" subordinate official. He was King of the Cove, the whole country side being delighted to do him honor. They looked upon him as their deliverer from "poortith," at least for a time. One of the historic, and not soon to be forgotten, events in the history of Inverness was the day of his departure for his home in the United States. He was escorted out of the village and a further part of the way by a long and imposing cavalcade, composed of the Yeomen from districts near and far in the county. It was a gala day, and a gushing and not a gloomy good-bye.

SUBMARINE MINING.

Prior to only fifty-one years ago there were only one or two in Cape Breton County, who dreamed dreams, and saw visions, in respect to mining coal from under the sea. And, strange to say, the man of farthest vision was not one to the "manor born," in fact he was not a mining man, but may have been called by the mining profession as a rank, and, at the same time, harmless outsider. The first of the few to attempt to put their visions in tangible shape was a minister and not a miner. In 1867 the Rev. Hugh E. Ross, who had as an associate Mr. W. H. Moore, took up under sea areas from Low Point to the South Head of Cow Bay. The lines ran two miles from the shore, in an easterly direction, and, of course, ran seaward. Roused and surprised by this intrusion, which came perilously near their territory, and which might be hemmed in by other ruthless or enterprising marauders, the agents of the G. M. A., later in the same year, took up areas at Table Head, Boularderie. The boundaries of these ran easterly, and likewise under the sea. The writer believes he is safe in assuming that in 1867 a strip of sea area 25 miles by two miles, comprising fifty square miles, were taken up, and all of this under-sea coal. It is to be feared that the G. M. A. people did not evolve the taking up a strip of under sea coal out of their own consciousness, otherwise they should not have been satisfied to take up so narrow a strip. Even though it may be declared that his

wisdom may be of the post facto kind, the writer must express the opinion that the mining men of the twenty odd years preceeding the coming of Dominion Coal must have been par blind and had not the prescience which might have been expected of them. For instance, take Sydney Mines. The folk in charge might have taken five miles out to sea, and prevented the Dominion Coal Company taking out areas in front of them; and the Dominion Coal Co. might have gone further to sea than they did, and have kept the Nova Scotia Co. out of its present fine under sea area. And again the Dominion Coal Co. in say 1893 might have gone the limit, and thereby prevented Scotia from taking sea areas in front of theirs between Bridgeport and Glace Bay. At least two of the big coal companies in turn, lost their opportunity. Unlike the person who cheeked up to Lochiel, none of them were wizards.

By the way at least four ministers prominent in C. B. County—or clergymen of that County, for it is said there is a difference—were largely interested in minerals—coal, clay and copper. The names of the four are Ross, Dr. McLeod, Father McPherson, and Murray. Stipends were, presumably, low in these days and little dependence could be placed in diminutive Augmentation funds.

Hugh Fletcher, speaking of the seams along the C. B. coast line, says: "The average thickness of coal in workable seams outcropping on the shore and for the most part exposed in the bays and cliffs, is from forty to fifty feet; the seams vary from three to nine feet in thickness. They generally dip at a very low angle and appear to be very little affected by faults or disturbances. As the strata all dips seaward, much of the coal will be available, in the submarine, as well as in the land areas. From experience at the Sydney Mines it has been established that with due caution and care, these submarine areas may be worked to a large extent.

In the opening remarks on submarine mining in Bulletin No. 14 of the Canadian Mines Department,

the author, Mr. F. W. Gray, is content to say: "Coal has been mined for many years under the sea." In view of the transcendent importance of the subject especially to Cape Breton it may be advisable to be somewhat more specific and give some details in regard to its beginning.

As afore related, Mr. R. H. Brown, in his paper read before the N. S. Mining Society, declared that the Princess pit was the first colliery in North America to begin the getting of coal from beneath the bed of the Atlantic ocean. On reading the statement the writer was not a little surprised. After due reflection he arrived at the conclusion that the statement, while, possibly, literally correct, might deceive those unfamiliar with the subject. It all depends upon the construction one places on the words "bed of the Atlantic Ocean." Wherever there is a break in the coast line by a bay, estuary or frith, does the bed of the Atlantic experience a break? The waters easterly of the inner Low Point Bar-light, and those at Cow Bay, are from the Atlantic Ocean. If it cannot be said that the majority of mines on the south side of the estuary dividing North from South Sydney, will soon be wholly under the bed of the Atlantic Ocean, it can certainly be said that they will be covered by the waters of the Atlantic and that they are submarine, and that is the essential fact. Princess pit was thus not the first submarine mine. If the writer is not wholly in error the first mine started to mine coal under the sea was the "Victoria" and that was several years before the Princess pit was in operation. Referring to the event, Jno. Rutherford, the first practical Inspector of Mines for the province, says:—

"The commencement of this colliery in 1867 attended with much interest in consequence of the peculiar position of the areas, as compared with other mining operations. The areas being entirely submarine it was the first attempt to work coal so situated, by means of a slope from the crop. The operations however, were not impeded by any diffi-

culty of importance, and the practicability of mining under such circumstances was fairly established. The slopes have been driven 300 feet to the dip, levels have been won out of them, and working places provided in the usual manner. . . I regret to say that operations have not been conducted with that care which the circumstances of position required; a larger proportion of coal than was warranted by the thickness of the strata between the bed of the sea and the seam has been injudiciously removed, and although no immediate danger may be apprehended an extension of the workings to the dip, would, I consider, be attended with risk. I felt it therefore to be my duty . . . . to recommend such steps to be taken as will tend to the security of the mine and the security of those employed in it."

The recommendations must have been complied with as no accident has as yet befallen the colliery, while in operation, which at times has—but not from accident—been interrupted. The management of the colliery did, however, on one occasion get a rather bad scare. There was a heavy inrush of water which drove all hands out of the mine. The opinion for the time was that the sea had broken in, and that it was all up with "Victoria." It turned out to be not so bad at all. The first gleam of hope came when it was noticed that the water in the mine did not ebb and flow. If it was salt water there certainly must be both. This led, of course, immediately to a trial of the taste, and lo! it was fresh. Where did so large a body of fresh water come from? It had surely come from a subterranean lake. The mine manager was certain of this and related a similar incident that he had knowledge of though the "lake" was a much larger one that flooded Victoria than the other. It is claimed for A. C. Ross, ex-M. P., that to him belongs the honor of having been the first to drive a pick into the seam at Victoria Mines. Though the starting of a colliery to run under the sea was, in those days, a momentous oc-

currence there was no formal, no elaborate, ceremonial at the opening, otherwise Mr. Ross would be the possessor, not of a silver trowel but that far rarer implement, a silver pick. Seeing so great an area of coal is submarine, especially over the coal producing counties in Cape Breton Island, the question arises, can submarine areas be as advantageously worked as those wholly on land?" and the answer is: "Not under present regulations and from a permanently economical standpoint, except in certain localities." There may be little disadvantage where there is 500 feet of strata intervening between the coal seam and the floor of the sea, or the bed of the ocan, but this must be qualified by the words "in some localities only," for it may be said that the strata has all to do with the method to be employed in winning the coal in submarine mines, and, strata varies. For instance, Mr. Brown in his paper says: "For many years all the pillars were left standing. They hesitated to remove the pillars in this submarine. They left a very large area of pillars." (The strata was 1100 feet thick.) "After inquiry in Britain it was determined to commence pillar work. In 1899 removal of pillars started at three points. Up till 1903, 465,000 tons of pillar coal had been extracted, also 46,000 tons from longwall section. Where, after the removal of the pillars, the roof came down freely, the falls do not proceed upwards to a height of more than 12 feet. No sea water found its way into the workings, as a result of the removal of the pillars. A feeder of a few gallons per minute was encountered in some of the whole coal workings driven to the rise, but this water evidently followed the seam downwards from the outcrop under the waters of the Harbor. There has been no water known to have come from overhead across the measures. The immunity from overhead leaks from the ocean is probably due to the presence in the strata of twelve beds of fire clay, of a total thickness of 39 feet in all, as well as to the numerous beds of shale which occur throughout. The subsidence of the overhead strata

eaused by the removal of a seam of eoal 6 ft. thiek would probably under those conditions soon ehoke itself, so that there would be no further actual motion, or setting of the strata for more than 100 feet upwards. - Above that point the elasticity of the beds of shale and fire clay would prevent any rupture. Fire elay when brough into eontact with water soon becomes a soft clay and impervious to water. (In making the Princess shaft, 33 ft. of sandstone were driven through at about 280 ft. below sea water level. The inflow was about 650 gallons per minute; the shaft had to be lined 500 feet down from surfaee. The G. M. A. had taken five and a quarter million tons of coal out of the submarine workings previous to the transfer of the areas to "Scotia.")

When Mr. Charles Fergie was in the aetive management of the Intercolonial Coal Coy., he was desirous of driving a portion of the workings immediately underneath the large pond whieh supplied water for colliery purposes. The hazard of the attempt caused him for a time to hesitate. Would there be a subsidence? Would it be serious enough to empty the pond, and take away the water supply, a more serious affair than a temporary inrush of water? There were only two hundred feet or less of overhead strata between the seam and the pond. Finally the risk was ran and not a drop of water came in, and the pond bottom did not subside. The fire elay had done what it was hoped it might do. In the drawing of pillars in the Glace Bay distriet there may be very great risk as the writer has been informed by a leading offcial of the collieries that falls many hundred feet below on the land area, have caused subsidences on the surface, resulting in damage to property. If the strata is uniform on land and under sea, then future mining engineers of the eompany will have a big problem before them.

But what of two mines that have been flooded by the sea Mabou in January, 1909, and Port Hood in June, 1911? On this point Mr. F. W. Gray remarks:

"At the point in the slope of the Mabou mine

where the sea entered there was only 110 feet between the roof of the slope and the sea bottom.

In Port Hood mine the water entered at a point where pillars were being drawn in the lowest level, supposed to be covered by 942 feet of solid measures. The inrush is estimated to have amounted to 3,000 gallons a minute in the initial stages, and the flow at the Mabou mine is thought to have been about 700 gallons per minute.

A Commission was appointed by the Nova Scotia Legislature to inquire into the causes leading to inundations.

Concerning the Mabou incident, the Commissioners consider it was an error of judgment to have entered the seam under the comparatively thin cover, having in view the nature of the overlying strata.

Regarding Port Hood colliery, the Commissioners advise that in future "every reasonable means should be employed to ascertain the depth, nature and condition of the overlying strata before pillars are extracted in any submarine area.

The inundation of the Mabou mine was quite evidently the result of poor judgment, but the Port Hood inundation was of a sudden and unexpected nature, and while subsequent investigation showed peculiarities in the overlying strata that partly account for the inrush, it has never been shown that the break could have been guarded against.

While actual physical conditions that led to this inundation are a matter of conjecture, and can probably never be exactly determined, it does not seem reasonable to suppose that the water from the sea entered through a vertical, or approximately vertical fracture in the roof of the seam communicating directly with the ocean. The connection with the sea is undoubted, because the water is certainly seawater, and there was noticed a small daily rise and fall of the water corresponding in time to the tides, showing that the point of entrance of the water was near the shore, where the fluctuations of the tide would manifest their influence.

The pumping equipment of the mine had a maximum capacity of 110 gallons per minute, and was, of course, entirely inadequate to deal with an inrush of water of any magnitude. There was no reserve lodgment for water, and under these circumstances it cannot be said the inundation was an uncontrollable one. Much larger streams of water are being daily controlled in other Cape Breton collieries than seems to have entered at Port Hood."

The writer can speak more freely about the Mabou mine than Mr. Gray possibly can, as he had been close to the spot where the water broke in, on a visit to the mine previous to its flooding. If at the point of the slope near to where the water entered there was only 110 feet, then there was considerably less than that where the water really entered. To the right of the slope, while the metals still ran at the high angle, there was a narrow place driven, with no conceivable object other than to send some coal to the surface. And then a short distance in this,—let it be called a recess—another place was driven to the rise, the object in this instance being presumably the same as in the other. The manager and the writer stood looking at water which came trickling—running down would be an exaggeration—down the pavement.

"Salt water?" was the query.

"Yes," was the answer.

"Why don't you build off; the water may increase?"

"Build off? What with? I have neither a stick of timber, nor a single barrel of cement."

It was not so much an error of judgment in the first place, as a desire to get coal, possibly for the engine, as she was a coal hog, that induced to the driving of the head, and it was the poverty, or rather bankrupcy of the operators which precluded the walling off. There was not necessarily any falling of strata. There was a cleft in the rock to which the undertow had carried sand and pebbles, thereby filling tightly the crevice. Through this crevice the

water trickled when the coal was removed and gradually the sand and pebbles were carried downwards until the water obtained free access. Mabou should never have been allowed to flood. Less than two hundred dollars would have built a secure stopping. The mine was not in operation at the time; the workmen had taken out liens, the government having the prior lien stepped in and took charge. The manager was allowed to resign. A mechanical engineer was in charge. He kept up steam to keep the pump in motion, but there were no materials on the surface available for any, even a minor, emergency. When the water rushed in the carekeeper called on the manager for advice. No advice could be given, as there was no material with which to do anything. There are people who desire all industries to be under governmental control. The Nova Scotia Mines Department made a poor fist of their control of Mabou. Some people think that seeing the mine was allowed to be flooded while under their control the government have a right to put it in the shape they got it. One of the several seams at Mabou contains coal which has no superior for metallurgical purposes in the province. The great disadvantage this fine property labors under is that it has no rail, nor easily accessible water connections. These however could be supplied at less cost than other companies have been required to pay in order to secure a way to market. The recommendations of the Commissions in reference to Port Hood do not permit of criticism, all the same they might have added to their recommendations: "Every care should be taken not to confound years upon years' accumulations of sand, with sand stone, or other stratified mineral." That would have given a hint as to one of the probable causes of the flooding of Port Hood. To quote a further paragraph from Mr. Gray:

"There is a marked difference between the conditions attending submarine mining on the western and eastern sides of Cape Breton island. On the wes-

tern side, in the Inverness coal-field, the strataare much fractured, and the coal seams dip steeply. In the Sydney coal-field the seams are but slightly inclined, and the strata overlying and intervening between the coal seams consist of strong sandstones and impermeable marls and shales. Faults are rare, and the sea bottom is usually rock, without great thicknesses of sand or sand pockets. A great part of this submarine coal-field is territory that has been gradually encroached upon by the sea, not by subsidence of the measures, but by erosion of modern date —geologically speaking. As the land area of the productive measures is remarkably free from faults or evidences of recent earth movements there seems no reason to anticipate the existence of faults in the area that has been encroached upon by the sea."

It is true that at the shore the Mabou mine dips at a steep angle, but a few hundred feet down the angle becomes easy, and the strata gives no token of break. The high angle, in this instance, near the shore is an advantage and not otherwise. The workings are well under the sea in a very short distance.

The following are the provisions in the Coal Mines Regulation Act relative to submarine mining.

(a.) No submarine seam of coal or stratified deposits shall be wrought under a less cover than one hundred and eighty feet of solid measures;

Provided, that the owner or lessee of any such area may drive passage ways to win the mineral to be wrought under a less cover than one hundred and eighty feet, but not less than one hundred feet of solid measures;

(b) A barrier of the mineral wrought of not less than fifty yards, twenty-five yards on both sides of the boundary lines of every lease, shall be left unwrought between the workings of every submarine seam;

(c) Where there is less than five hundred feet of solid measures overlying the seam or stratified deposit wrought, the workings of every such submarine area shall be laid off in districts of an area not

greater than half of one square mile, and the barrier enclosing each separate district shall not be less than thirty yards thick, and shall not be pierced by more than four passage ways having a sectional area not greater than nine feet wide and six feet high; Provided that the Inspector may, if he deems it necessary, permit said passage ways to be driven with a cross section, not exceeding sixty square feet;

(d) No district shall have its length when parallel to the general trend of the adjoining shore greater than one mile;

(e) A proposed system of working the mineral in each submarine area shall before work is commenced be submitted to and approved of by the Inspector; and no change shall be made in such approved system without the written sanction of the Inspector;

(f) The opening of a new lift or level in a mine already working in a submarine area shall be deemed the commencement of a new winning within the meaning of the section."

One may readily fancy that too much responsibility rests with the Inspector, who may not have had extended experience in regard to under sea mining. The government should at first take steps to ascertain the nature of the strata over every submarine area in the province and also conditions in general, and this done call every expert on mining in the province to a consultation, and formulate, as far as possible, rules generally to be observed in the several districts, and special rules for special cases. This should be done looking to the future.

BYE PRODUCTS OF COAL.

This is a most alluring and a very fertile subject. When one speaks of the wonders of coal tar, he, of course, speaks of the wonders of coal, coal tar being the bulkiest and the most easily obtained of its bye products. To some the wonder is, not that the wealth in coal tar has been made manifest, but, that the exposure of this wealth was so long in being revealed. Boys living near tidal harbors, which at low tide permitted of the coating of lighters and small coasters with coal tar, have stood and admired, when the tide came in, the many beautiful colors, varied as the rainbows, floating on the surface of the water, and extracted from the coal tar. Sixty years ago, or so, there were not, in common use, analine dyes, a bye product which is only one of a hundred of wonderful articles of commerce obtained from coal.

The subject is so rich and so much has been written and said upon it that the difficulty is to know rightly where to begin. Therefore if the contents of this Chapter are somewhat disjointed it may be put down to an embarrassment of riches?

Ira Remsen, President Emeritus of John Hopkins University, contributed the following paper to an American publication:—

When soft, or bituminous, coal is heated in a vessel that has only a small outlet and no inlet for air, it does not burn, but it does undergo great changes. Gases and liquids form and, passing out through the small outlet, leave behind a solid that is familiar to

the world as coke.

COAL TAR A PANDORA'S BOX.

In the making of coke, as well as in the manufacture of illuminating gas, there is always formed a thick, black liquid, more or less viscous, called coal tar. For many years it was regarded as a nuisance to be got rid of as soon as possible. To some extent it was used for making tar paper and for preserving lumber, but the quantity used for those purposes was very small compared with the quantity formed. Coal tar would never have become so famous as it is now if chemists had not become interested in it.

In 1845, A. W. von Hofmann, then a young man of twenty-seven years, who afterwards became one of the leading chemists of the world, discovered that, when coal tar is heated in a closed vessel with an outlet so arranged that the escaping vapors pass through a long tube surrounded by cold water, the vapors are condensed and form a liquid, just as water vapor, when cooled, forms a liquid water. He also found that the liquid first condensed consists largely of a substance that had previously been obtained from benzoic acid. It is called benzol, and is now known to chemists as benzene. That was the beginning of the scientific study of coal tar.

The wildest dreams of the pioneer workers in this field must have fallen far short of the results that followed. Coal tar, the despised nuisance of the middle of the nineteenth century, has become a veritable Pandora's box from which almost anything may be expected.

At the suggestion of Hofmann one of his pupils, Mansfield, undertook a more thorough study of the products formed when coal tar is distilled. The results were published in 1849. Neither Hofmann nor Mansfield foresaw then that the work they did would be likely to have any commercial value. They were merely trying to find out all they could about this tar. When they found that some of the products

they obtained from coal tar were commercially useful, Mansfield undertook to distill the tar on a large scale, and, sad to relate, lost his life in consequence of an accident in his factory.

The next step in discovering the wonders of coal tar, and a most important one, was also taken in Hofmann's laboratory. While Hofmann was away on a vacation a young Englishman, W. H. Perkin, who was serving as an assistant, tried some experiments of his own with the ambitious purpose of preparing artificial quinine. The experiments did not turn out as he hoped, but he noticed that in some cases a colored product was formed. That led him to undertake further experiments in the hope of obtaining colored products that might prove of value as dyes. In one of those experiments he used aniline, and discovered a black substance that did not promise much. He found, however, that when he treated it with alcohol a lilac-colored solution resulted. From that solution he obtained the first aniline dye. It came to be known and is still known as mauve. It has also been called Perkin's violet.

Although mauve was the first aniline dye, it was not the first coal-tar dye to be made. That honor belongs to pieric acid, a yellow dye, which Woulfe discovered in 1771; he made it, however, not from anything then obtained from coal but from indigo. Pierie acid has become a much-prized substance and is now obtained from coal tar.

The discovery of mauve led at once to active work with the object of finding out what that other colored substance and whether other colored substances could be formed from aniline. The most astonishing results followed. The chemists discovered that an almost infinite variety of colored substances could be made by comparatively simple methods.

Some of the substances were valuable as dyes and some were not. The dyes first made were in many cases rather harsh to the eye, and although they were extensively used, they gradually came into dis-

repute. Then, too, some of them came to be used illegitimately—to color preserved fruit, for example. At one time arsenic was used in making one of the best-known aniline dyes, which was used in dyeing stockings; it was popularly believed that the dye caused poisoning.

Notwithstanding the prejudice thus created, the aniline-dye industry grew rapidly, and new and better dyes were soon discovered. Among the dyes that were found practically useful only a few need be mentioned here: Hofmann's violet, Paris violet, crystal violet, opal blue, night blue, Victoria blue, glacier blue, dragon green, acid megenta, navy blue, night green. It may be said that almost any color or shade can be made, although not all the colors are fast. One of the most valuable aniline dyes is aniline black. It shows great resistance to the action of soap, light and air.

Now, let us go back for a moment and inquire what aniline is and what connection there is between it and coal tar. Aniline was first made from indigo, which is obtained from the plant known as Indigofera anil. Chemists later found that they could make it from benzol. Thousands of tons of aniline now come annually from that source. The connection thus established is this: Coal gives coal tar; coal tar gives benzol; benzol gives aniline; aniline gives aniline dyes.

ARTIFICIAL INDIGO.

But benzol is only one of hundreds of substances obtained from coal tar. Another is toluol—called toluene by chemists. It yields a substance that is similar to aniline and that in turn yields many colored substances useful as dyes. Those are also called aniline dyes.

Another substance obtained from coal tar is naphthalene, familiar to the world at large in the form of "moth balls." Naphthalene has come into prominence because it serves as the starting point in the manufacture of a large number of beautiful dyes,

such as various oranges, fast red, Congo red and benzo-purpurin.

Indigo is one of the most highly prized and most extensively used dyes. Until a few years ago it was prepared entirely from the indigo plant, but at present it is manufactured. In making it, naphthalene plays a leading part, and so indigo must now be classed with the coal-tar dyes. It is well to observe in passing that when artificially prepared indigo was first put on the market there was great prejudice against it. It was said that it was not the same thing as the indigo made from the plant and that it therefore could not be used for the same purposes. In spite of the objections, artificial indigo has made its way and has virtually displaced the natural dye. There is not the slightest question of its being the same thing. But, futhermore, it is better than the natural indigo, for that always contains impurities, whereas the artificial product can be made pure.

Among the products obtained from coal tar is anthracene. It "began life" as an obscure substance with apparently no hope of acquiring fame, but it has risen to great prominence because two chemists found that they could make from it the well-known dye Turkey red, or alizarin. Alizarin had formerly been obtained from madder root, and madder was cultivated extensively for the purpose. But in 1868 two young German chemists undertook to find out what alizarin is; they treated the substance in many ways and in one experiment obtained anthracene from it. That gave them the clue. They reasoned that if they could get anthracene from alizarin they might be able to get alizarin from anthracene. That proved to be not very difficult, and Turkey red is now a coal-tar color—one of the wonders of coal tar. In this case, as in that of indigo, the manufacturing chemist has taken the place of the cultivator of the soil.

The dyestuff industry of to-day is based almost wholly upon coal tar. The dyes in the market are not all aniline dyes. Many are not at all related to

aniline. The expression "coal-tar colors" is, of course, broader, and includes most dyes in use.

But other valuable substances that are not dyes are obtained from coal tar. There is a long list of coal-tar substances used in medicine, many of which are undoubtedly beneficial—some of which perhaps are not. Among the more familiar ones may be mentioned atophan, anti-pyrine, antifebrine, aspirin, salicylic acid, salvarsan. The effects of many such substances upon human beings have been studied with great care, and their value as remedies is thoroughly established; in other cases there is not a sufficient basis of knowledge to justify our using them. It seems not improbable that, as investigation proceeds, many specific remedies will be added to the short list now at our command. It is however, only through long-continued scientific study that the desired result can be reached. A great field is open, which has been cultivatd only to a slight extent.

Some of the most valuable perfumes have their origin in coal tar or are related to coal tar—and some of them are in the nature of frauds. When benzol is treated with nitric acid a compound known as nitrobenzol is formed. It has an odor that suggests the oil of bitter almonds—a fact that has led to its being used under the name of "artificial oil of bitter almonds," although the two substances are not at all closely related. Its chief use is in the manufacture of soap. No harm is likely to be done to the person using it; yet the name is a fraud. "Essence of mirbane" is another name given to it. That is also objectionable, for the substance is not an "essence" and "mirbane" is merely a trade name.

Essence of wintergreen, or oil of wintergreen, which is related to salicylic acid, is made artificially and is widely used on account of its pleasant odor. As a remedy the artificially prepared substance is identical with that obtained from the plant and there is no objection to using it if precautions be taken to prepare it in pure condition.

Vanillin, the odorous constituent of the vanilla

bean, is now made artificially, although not from coal tar. Nevertheless, we may confidently expect that the time will soon come when it will be obtained from one of the constituents of coal tar, for it is closely related to some of them. The same may be said of heliotropin, an artificial perfume, which is extensively used.

By far the most important of the substances obtained from coal tar that are used, because of their taste is saccharin. It is about five hundred times sweeter than sugar; when you take it into your mouth it tastes like sugar, but that first taste is followed by a slight sensation of bitterness. Nevertheless, saccharin is used for various purposes, although in several countries its use is prohibited by law.

THE VALUE OF SACCHARINE.

In view of that prohibition, the first and most important question that suggests itself is this: Is the use of saccharin objectionable on the score of health? Those who have investigated the subject most thoroughly say that it is not. I can safely say that small quantities of saccharine—such quantities as would be likely to be used—are not injurious.

Another question that has been raised, and very properly, is whether saccharine is used, or can be used, in any way that can be regarded as objectionable. To discuss that question properly we must take many things into consideration and must present many facts; there is not space to do it here. Suffice it to say that the saccharin problem, which has acquired national significance, will no doubt in time be solved satisfactorily.

Finally, another class of substances obtained from coal tar calls for mention. The substances in this class are used on account of the ease with which they explode. Many explosives are known, but the two that are related to coal tar are picric acid and trinitrotoluol. Picric acid has already been mentioned as the first coal-tar dye; it was made by the action of nitric acid on indigo. It is now made in en-

ormous quantities by treating carbolic acid with nitric acid; and most of the carbolic acid used is made by starting with benzol. Carbolic acid is known to chemists as phenol, and picric acid, as trinitrophenol.

Some of you will perhaps remember that during the South African war it was at times noticed that the skin of those engaged in a battle became yellow. That was a result of the contestants using the explosive lyddite, the chief constituent of which is picric acid. The latest explosive is, however, trinitrotoluol, which is being used extensively in the present war; the chemists make it by treating toluol with nitric acid.

It is interesting to observe that the three most widely used explosives have names that resemble one another; they are trinitroglycerin, trinitrophenol and trinitrotoluol. Indeed, if we go back to gunpowder we find that nitre, or saltpetre, is, so to speak, the milk of the cocoanut. Now, nitric acid is obtained from nitre, and the three explosives named are formed by treating glycerin, phenol and toluol respectively with nitric acid.

Probably enough has been said to give at least a slight impression of the "wonders of coal tar." Starting with the black, offensive substance that is always formed in manufacturing illuminating gas and in preparing coke, it is possible to obtain:

1. An almost infinite variety of dyes of any desired color.
2. Substances that are extensively used in medicine.
3. Perfumes, delicate and otherwise.
4. Substances used because of their taste, chief among them, saccharin, five hundred times sweeter than sugar.
5. Explosives of the most violent type.

The end is not yet. Chemists are at work in many laboratories throughout the world, and the experience of the past justifies us in the confident belief that of the wonders of coal tar there is not likely to be an end.

WEALTH FROM WASTE.

A writer in a Scottish paper under the title "Wealth from Waste" refers to several of the bye-products of tar. The title is crisp enough but the word waste may be unsuitable in view of the present value of coal tar. A truer title might have been "Present wealth from former Waste." The writer of the article in the Scottish paper seems to have later information than President Remsen. The following three paragraphs are from the article:

The essential flavouring substance of the vanilla bean, known to chemists as vanillan, as well as other essences, is manufactured out of coal tar and the oil of cloves. Coal tar, of course, is one of the most valuable and wonderful of all waste products, and it would be almost impossible to compute the added wealth with which it has enriched the human race.

Antipyrin, one of the most valuable medicines in nervous diseases, is one of the products of tar. For the production of dye-stuffs, too, coal tar has become almost indispensable, and to most people it still remains a mystery how all the most delicate hues of the rainbow can be produced from such an oily, dirty substance.

Sweetness is just about the last thing one would associate with coal tar, yet it is a fact that from this despised product—which at one time was so great a nuisance to the gas companies that they actually paid for permission to drain it into the common sewer, as the simplest way of getting rid of it—is obtained saccharin, a substance three hundred times sweeter than sugar."

Though, as stated, the subject is a fertile one it is possible that not many even of those engaged in coal mining in Nova Scotia and whose future is bound up with the production of coal have anything like a full conception of the wonderful part coal is playing in this great war. Some know that at a big work in Cape Breton, toluol, which plays a part in the manufacture of a high explosive, is being pro-

duced. More know that from coal is produced aniline dyes, but we venture the opinion that few are aware that these dyes and high explosives are intimately connected. No excuse therefore is necessary for publication of the following in reference to Aniline dyes which appeared some time ago, in a British publication. If King Coal is great in peace it is also most wonderful in war:—

"Mr. Milton S. Sharp, presiding at the annual meeting of the Bradford Dyers' Association, said that the establishment of the synthetic dye industry in this country was vital to our national safety. Dyes and high explosives were very closely correlated. Benzol, toluol, carbolic acid, sulphuric and nitric acids were the raw materials from which dyes and high explosives alike were made, and it would indeed be a tragedy if they failed to learn the lesson the war had taught—namely, that ability to produce unlimited quantities of those articles was one of the first essentials of any hope of success in warfare. The complete, self-contained, and independent manufacture of aniline dyes within the United Kingdom was essential to the commercial and martial protection of the State.

The raw materials from which aniline dyes are made being the same as are used in the manufacture of high explosives, picture to yourselves (the Chairman continued) the enormous advantage Germany had by reason of her huge, highly-organized and ably administered colour-works, producing all the raw materials required for the making of high explosives, and able immediately to divert much of their colour-making plant to their manufacture. What was our position? Why, exactly the same as our position in regard to the army. We had to improvise an army. We had also to improvise our production of high explosives. We have done both, and to a degree which our enemies will find to their cost and sorrow before very long.

The country will probably never know how much it owes to the High Explosive Department of the Mi-

nistry of Munitions presided over by Lord Moulton, and officered by a body of strikingly able and energetic men, to whose commanding force it is due that the danger from a shortage of high explosives has been so effectively met.

What I desire to urge with all the force of which I am capable is that we must never again jeopardise our national safety by the risk of shortage of high explosives, and that, whatever it involves, we must establish the aniline dye industry in this country. Until we do this we shall always be at a great disadvantage as compared with Germany. I am confident if public opinion could once understand the situation it would be practically unanimous in demanding the most thoroughgoing and drastic action, quite regardless of cost.

One my last journey to Germany, just before the outbreak of war, I visited all the large colour works, and it will bring home to you what terrible instruments such works are for enabling the German Government to carry out its policy of frightfulness when I tell you that one company alone, then employing about 10,000 men chiefly in the manufacture of aniline dyes, today, I am credibly informed, are employing about 14,000 men almost entirely on the manufacture of high explosives. Only those with some knowledge can realise the facility with which a color works can be converted into a high explosive factory. Another works visited at that time employed about 9,000 men in the manufacture of aniline colours and pharmaceuticals. I have information to which I attach entire credence that today those works are engaged almost solely in making T. N. T. and picric acid for the German Government.

During the course of the same journey I gathered that 75 per cent. of the collieries in Germany had coke ovens installed. When it is realised how vitally important the distillation of coal in coke ovens is in relation to the manufacture of aniline dyes and high explosives, it will be seen how this alone gave Ger-

many an enormous advantage over us in the early stages of the war, as the by-products from the coke ovens are amongst the most important materials for making colours and explosives, whereas in Great Britain at the outbreak of the war only some 25 per cent. of our collieries had coke ovens installed.

I was also told that three of the principal German colour-making concerns, who pool their products, had shortly before increased their capital by £2,250,000 for the purpose of erecting a works for the production of ammonia from the air. At that time they estimated they would produce 130,000 tons of ammonia per year; it has since been stated that this production has been increased to 200,000, and is now being converted into nitric acid. The raising of so much capital for such purpose is noteworthy even on the surface; but it is even more striking in the light of our now certain knowledge as to the preparations of Germany for war. It is impossible to avoid the conviction that the use of such a plant in the event of war was duly taken into consideration. It has been said that the supply of high explosives to the German army would by this time have ceased had it not been for that plant. It is quite possible that the stocks of nitrate of soda would now have been exhausted, and without nitric acid no high explosives can be made.

How can the establishment of colour and chemical works be accomplished here? No one with any knowledge would venture the opinion that it can be attained through British Dyes, Limited, alone. I wish to speak with great respect and the deepest gratitude for what that company has done. Faced with a tremendous task, made incomparably more difficult by the prior claim of explosives upon the raw material, it has done really splendidly. The want of raw materials has hampered the efforts also of all the British, Swiss, and French makers. When such difficulties disappear, I am sure British Dyers, Limited, would not claim that they alone will have the power to free us from German domination in

this, the greatest "key" industry—a key not only to export business aggregating £200,000,000 a year and to the employment of some 2,000,000 people, but, what is of far greater moment, also to the national safety. Indeed, I make bold to say there are few things which this terrible war has made more clear than that both from the economic and national defence standpoints there is no question of greater urgency than the rapid establishment of the aniline dye industry in this country. It certainly calls for further and immediate action by the Government and Parliament."

* ** *

At the present time few are in a mood to say a word that might be classed as favoring Germany. But even though we now disown her and her works, there is no necessity that there should be a refraining from giving the devil his due. If many things can be said against her there is at least one that must be said in her favor. She leads the world in the matter of by-products from coal. In fact some of the by-products are produced in no other country but Germany and hence the plea of Canadian paper makers for the increase in price of all papers and boards other than white. This dependence upon Germany for dyes, the by-product of tar, which is the basic material in their production, has caused great inconvenience the world over. Owing to the fact that Germany was the one big producer, many medicines, which have come into vogue of recent years, have increased in price many times. This is particularly the case with such drugs as phenacetin, antipyrine, aspirin, and other of the coal tar series. Up to the present neither American nor British manufacturers have quite overcome the difficulties in the way of their economical production. Aspirin may be an exception as it is at the present time being made in Britain, in fair quantities. And great efforts are being put forth for the production of dyes. A plant is being erected for their production on a large scale. It is said the plant will give employ-

ment to ten thousand men. In Germany at the present time attempts are being made to increase the sale of coke so that its by-products may keep many industries in motion. The following from the bulletin of the American Chamber of Trade, Berlin, shows how important a part coal and its by-products play:

"Tar, being the principal by-product in the making of coke, is the basic material for the greater part of the organic chemical industry, as it is used in the manufacture of aniline colors, disinfectants and medical supplies, perfumes and photographic supplies.

Furthermore, tar is utilized as a means for the preservation of building material, as fuel for Diesel engines and for ship boilers, etc. In this connection it will be of interest to know that before its combustion valuable parts of the tar are obtained by distillation.

Pitch from tar is used in the manufacture of brickets, and the sulphate of ammonia obtained is used as fertilizer in the raising of sugar beets, potatoes, rye and barley.

Moreover, ammonia is used in the manufacture of aniline colors, of explosives and artificial silk, by bleachers and dyers, and in the making of artificial ice.

Of special importance, since the beginning of the war, is the valuable by-product benzole, which now is replacing gasoline.

These are the reasons why efforts are making to increase the use of coke, and therefore coke, formerly a by-product itself, is now the principal product obtained. In order to encourage the use of coke, particular attention has been paid to coke prices, making them as low as possible.

It may be asked why Britain, and the United States, have allowed Germany to obtain the lead in the matter of coal tar by-products. One reason probably is that the coal tar dye industry is really a conglomerate of many separate parts acting and reacting upon each other, commercially and industrially.

Not a single one of the 22 factories in Germany is wholly independent of other factories in Germany, whereas together they are independent of sources outside of Germany, or can very readily be so should occasion arise. It would not do merely to transplant even the largest German works to this country; a part of probably each German works would be necessary to produce here or anywhere a complete and self-contained industry. Such a transplanting of the coal-tar dye industry would be comparable to an attempt to transplant to this country every single branch of, say, the textile industry or any other highly ramified and diversified art.

Germany's supremacy in this field has been for more than 30 years a standing challenge not only to the chemists and capitalists of the United States, but to the chemists and capitalists of all the rest of the world as well. Except Switzerland, no country has succeeded in selling to Germany more coal tar than it buys from Germany, but all of them without exception buy more of intermediate products, i. e., division 2, from Germany than they sell to Germany."

* * ** * *

The big law suit a few years ago between the Dominion Steel and the Dominion Coal, was over a matter of sulphur in coal. The lawyers on one side condemned the coal as unsuitable because there was sulphur in it, while the contract called for coal from the seams with least of what at the time was termed wholly an evil. Sulphur may not improve coke but it is folly to say today it is good for nothing. It looks as if from hence it will be among the favored by-products. The following in reference to sulphur in coal may be serviceable:

"As is well known, all bituminous coal contains sulphur. This is present chiefly in the form of a brass-yellow metallic mineral, known technically as pyrite or marcasite, but called commercially "coal-brasses" and termed by the miners "sulphur." This material occurs as small seams, lenses, and nodules scattered through the coal, and is generally looked

upon as an objectionable impurity, because it must be removed before the coal is marketed.

As a matter of fact, however, this so-called impurity is a raw material of value for the manufacture of sulphuric acid and its worth at present is from three to four times as great as that of the coal itself. Its recovery, therefore, in those mines in which it is now thrown aside affords a good opportunity for turning a troublesome waste product into profit, and thus establishing a new source of revenue with little added effort. Into such strong demand has pyrite come that there is even a possibility that some mines, abandoned because of the unusually high sulphur content of their coal, may be reopened and successfully operated as pyrite producers, with coal as the incidental or by-product.

To those operators who are interested in the commercial possibilities of pyrite recovery, reference may be made to a publication by E. A. Holbrook, issued by the Engineering Experiment Station of the University of Illinois, dated August 20, 1917, and entitled, "The Utilization of Pyrite Occurring in Illinois Bituminous Coal," copies of which may be obtained by addressing the State Geological Survey, Urbana. This paper gives detailed specifications, based on careful experimental tests, for a simple mill, which may be installed at an approximate cost of $18,000, capable of producing from hand-picked material 50 tons of commercial pyrite per eight-hour day, at a profit of $1.50 a ton."

WEALTH EVEN IN MINE WATER.

The dictum of science these days seems to be "Nothing can impede my onward march." Not only from the coal but from the very water which percolates into and is pumped out of the mine can substances of value be obtained. The following from a United States writer on coal is interesting:—

Engineers and chemists of the United States compute that pollution of streams from which Pittsburg gets its water supply costs manufacturers,

railroads and householders not less than from eight to ten millions of dollars annually. This cost is computed after careful investigations extending over a period of nearly three years. The information was gathered from manufacturers, railroads, business houses and house-holders, and the results have been embraced in a report that is shortly to be sent to Washington.

The sources of stream pollution are mine drainage, drainage from manufacturing establishments, sewage and a number of miscellaneous causes. Mine drainage is the attributed cause of the greatest cost; for it has been found that all the little streams that feed into the rivers carry a large percentage of valuable chemical substances, and that these are so corrosive in their effects on steam boilers, water supply lines and household plumbing that the life of such is abbreviated by about 60 to 80 per cent. of normal life as determined by comparisons with such installations in communities where water pollution is not as acute as in the Pittsburgh district. Like investigations are being conducted by the engineers of the War Department in other communities with like results, but less acute and less costly to the inhabitants.

After ascertaining the destructive effect of the chemical elements contained in solution in water, investigation was directed to finding a remedy that would be commercially feasible from a competitive viewpoint. This has been found in the discovery that the solids and acids that are contained in the streams, and especially the Monongahela River, now being lost, if recovered, would yield a profit and greatly magnify the industries of the community and multiply employment for a large number of technicians and others. As the greatest source of pollution is mine drainage efforts were made to enlist the co-operation of mining companies in the recovery of wastes from this source.

One result of this is that the H. C. Frick Coke Co. is now constructing a chemical laboratory at its

Davidson mine, near Connellsville, for the recovery of the chemicals from the water flow of the mine, which averages between 40,000,000 and 50,000,000 gallons of water a day, and from which, laboratory demonstrations have determined, about one ton of chemical per million gallons is possible and would be profitable. These chemical recoveries will be hydrates for the purification of manufactured gas; agricultural fertilizers; paint pigments, and sulphuric acid; more than a million gallons of which are used in the Pittsburgh district in the tin-plate and galvanizing plants every year.

It is maintained by A. K. Hoffman, the engineer who has been in charge of these special investigations, that any and all of these chemicals can be produced from mine-water at a cost that is much below what they now cost manufacturers and farmers and paint manufacturers, and that in this way commendable results may be achieved—first, an abatement of the destructive effect of the polluted water; second, a source of incidental income that would make coal mining profitable, or to lessen its cost to consumers.

Mr. Hoffman said that so far as the United States is concerned in this investigation, which was instituted after complaints had been made to Representatives in Congress from cities and towns in the lower Ohio Valley, charging pollution as arising in the Pittsburg district, the commercial side of the question only is being considered. Mr. Hoffman went on to say that, as a result of his engineering and commercial investigations in this direction, he is of opinion that chemical products for which the immediate community and the country at large are paying millions of dollars anually to foreign countries can be produced at home at a much lower cost."

NOVA SCOTIA TAKES NOTICE.

Something is being done in the way of recovery of coal bye-products in Nova Scotia, and there is hope of a soon extension. In Bulletin No. 14 of the

Mines Department one reads:—

Coke is manufactured in by-product ovens at the works of the Dominion Iron & Steel Company and the Nova Scotia Steel & Coal Company. The by-products recovered are sulphate of ammonia, tar, and latterly benzol. The waste gases are used in the open-hearth furnaces, in re-heating furnaces, and in the various processes of steel-making, and for steam-raising. The ovens of the Dominion Iron & Steel Company yield from eight to nine gallons of tar per ton of coal carbonized. The tar is taken by the Dominion Tar & Chemical Company, which has a plant immediately adjoining the coke ovens, and is there fractionally distilled for the manufacture of light oils, carbolic acid, creosote oil, disinfecting fluid, protective paints, pitch, and other tar products.

In 1915, the Dominion Iron & Steel Company commenced the recovery of benzol, and the distillation of toluol, at the request of the military authorities. The toluol is shipped to the Province of Quebec for nitration and the manufacture of the high explosive tri-nitro-toluol. Previous to 1915 the benzol had not been recovered.

It is also possible that the recovery of the carbolic acid for the manufacture of picric acid may be undertaken at Sydney; and in view of the large amount of explosives that are used in Cape Breton in mining coal, and in mining iron ore and limestone for the steel works, both in Cape Breton and in Newfoundland, there would seem to be an opening for the local manufacture of explosives.

It may be of interest to note that the Dominion Iron & Steel Co. make sulphuric acid which is used in the manufacture of sulphate of ammonia, and in one or two processes connected with the manufacture of steel wire.

The writer in Bulletin 14 adds:

The manufacture of coke on a small scale nearer the larger centres of population would provide a clean fuel, and if combined with a modern plant for

the recovery of the by-products, and the complete utilization of the gases, would not only provide a profitable market for slack coal, but would substitute a Canadian product for anthracite now imported from the United States."

When he wrote that paragraph the author of the Bulletin evidently forgot that Halifax was a city under a bureaucratic form of government and would have nothing to do with gas works coke. Neither should surprise be expressed that there are only two gas works in Nova Scotia. There was a third: electricity snuffed it out. When gas is transmissible, like electricity by wire it is possible to hope for a revival of gas for domestic and local purposes, not sooner, that is at any distance from the centres of coal production.

VAST INCREASE IN MINERAL WEALTH.

It has unhesitatingly been declared that "Cape Breton Island contains the most important coal fields in Eastern Canada." Without any intention of wrangling over the point, the assertion may not be permitted to go unchallenged. Had the statement ran "Cape Breton Island contains the largest collieries in Eastern Canada" it would be folly to contradict, but as it stands it is open to challenge. The geologists tell us that there are some twenty odd seams in Cape Breton County with a total thickness of a hundred and sixteen feet of coal. In Pictou out of the numerous seams five can be selected which will give a thickness of 128 feet, or twelve feet better than southern Cape Breton's twenty-one; or, leaving out the biggest seam of all, six can be selected to match Cape Breton's twenty-one. This cannot be looked upon as an odious comparison, nor is it so intended; it is made solely in the interests of fair play. Each of the mining counties is big enough and brave enough to stand upon its own bottom, without encroaching on the self-esteem of the others, and, possibly and very frankly, the challenge is issued merely as a diversion to expel monotony.

In the chapter on "Nova Scotia's coal areas," Cape Breton is credited with having a possible coal tonnage of 5,664,000,000 tons. This estimate is a compromise. Some authorities are content with lower figures, while others are inclined to place them higher. The following calculation has been given by

one who has a penchant for big figures, and it is to be noted that the calculation applies to the Sydney Mines, Glace Bay and Cow Bay districts alone. The square miles in the land areas are computed at 122 and the sea areas at 118. If a seam supposed to exist but not named, underlies the Glace Bay and the Cow Bay districts, then the workable tons on land will be 3,780,000,000, and under sea 3,269,000,000, a total of 7,049,000,000 for Cape Breton County alone. To some these figures may be interesting but not highly informative. The real question is not how much coal Nova Scotia has under land and sea, but what is the possible quantity likely recoverable.

Up till within a few years people were inclined to look upon the Pictou field as somewhat unimportant, when compared with that of Cape Breton. The results within the last two or three years, of the borings of the Acadia Coal Co., in the Stellarton district, demonstrate that Pictou has more and highly valuable seams than were formerly accorded her. To use a common expression, she seems to have more coal seams than one can "shake a stick at." The following section shows what is known to date, but as it is expected further seams may be discovered, it may soon again have to be revised. The numbers down to No. 7 are taken from the late H. S. Poole's reports; those following show the results of the recent borings by the Acadia Coal Co. under the supervision of their keen, foresighted, Chief Mining Engineer F. E. Notebaert. These borings tell a wonderful story, and there may yet be more to tell. The thickness of the several seams so far discovered may be safely placed at 200 ft. of workable coal. The thinner seams may be left out of the count. When the borings stopped for a time in March, 1916, coal men were amazed at the success which had attended the operations. They were further astonished, indeed it may be said astounded, when borings subsequent to the date mentioned, brought knowledge of two more big seams, one 24 ft. and the other 23 ft. in thickness, with measures between the two of less

than a hundred feet. And that is not all; there is more to follow in due time. The boring for a time has ceased. Why? Simply because the several revelations were beginning to look like fairy tales and it is necessary to allow to the people of Nova Scotia time to realize and form an estimate of the magnitude of the discoveries; and, possibly for the further reason that it should scarcely be expected that the Acadia Coal Co. while adding to its own knowledge the vastness and the value of the holdings of the company, should at the same time do work that surely must prove of inestimable value not only to Pictou County but the entire province.

The borings no doubt will give pause to the speculations which have been rife for many years as to the position of the Drummond Main and the other seams in the Westville areas as to their relation with the seams in the Stellarton district. It has now been all but practically laid bare that the Westville seams underlie and proceed under those at Stellarton.

The late H. S. Poole, a high authority on the geology of Pictou County, gave it as his opinion that the site presently occupied by Stellarton, formed in ages past the centre of a large, deep bay. What remains yet to be determined is, where is or was the bottom of this bay, and its extent. There is no doubt, as stated, that there are other seams below the one last discovered, how many nobody can tell. The seams lately discovered have so comparitively thin strata intervening, that in speaking of them the use of the word "seams" will have to be abandoned and the word "deposit" substituted. Why, even now it may be said of the Stellarton district that it is one intensive coal formation.

Borings also by the Acadia Company in the Coalburn district, have brought to light several seams of coal of commercial value. The present management of the Acadia have to be credited with having doubled the value of a previously most valuable property.

QUALITY OF N. S. COALS.

There is no striking differenee in quality between the numerous seams of coal in the province, that is those seams whieh have been and are being exploited. Their character has frequently been eompared to that of one or two of the northern and midland counties in England. Some elaim that they are in no way inferior to the eoals of say, Yorkshire. The analyses show very little differenee between the two coals. The value of a coal cannot very well be formed by a eomparison of analyses. In comparing the analyses of the coal from two collieries, in two seperate eounties, there is no desire to make invidious comparisons, the one desire being to show that one eannot, by the given analyss, form a eorret opinion as to the practical relative values of different eoals. Deeimal fractions are omitted in the following analyses of four Provincial eoals:

Name of eolliery	Vol. Matter	Fixed Carbon	Ash
Intereolonial	26.90	65.00	8.00
Aeadia	28.00	61.00	10.00
Port Hood	35.00	56.00	9.00
Inverness	46.00	47.00	7.00

A reading of the figures might lead to the eonclusion that the first named coal is the best, and the last of least value. In praetice has it really been found so? The Intereolonial Coal was prized as a steam raiser; the Acadia had a wide reputation as a

domestic fuel. In the case of Port Hood and Inverness it can safely be said that the Inverness Coal is not in any sense a less desirable coal than the Port Hood. Indeed the writer doubts if there is a more pleasing domestic coal in the province than Inverness screened; and, than one of the seams at Mabou the writer is prepared to say that, in spite of the analyses given, there is not a finer metallurgical coal in the province. According to the analyses the "Gardner" is in the A.-1 class. There are, however, drawbacks as well as compensations. The draw back in the case of the Gardner is that the seam is thin. It has been stated that the coals having a higher per centage of volatile matter are well suited for gas making purposes, and for coke making. It might be hazardous to accept either statement too readily. The Pictou County coals are low in volatile matter, and yet they have at all times been considered rich gas producers, and very good cokers, the reason presumably being they were low in sulphur. Lingan had much less volatile matter than Chignecto and yet it was in demand for United States gas works, while the high sulphur in Chignecto detracted from the coal as a good coke producer. In analyses given by the Ottawa Department of Mines the ash in the Inverness Coals runs as high as twelve per cent. No objection might be taken to this if the ash in other coals in other counties had been placed as high. Submitted to practical tests the yield of ash in any coals seldom falls below 12 to 15 per cent. If one goes by analyses the ash in the coal of one seam at least, in Mabou, is remarkably low in ash; and domestic users of Inverness are ready to make similar affirmation. The writer disagreed with a coal expert as to the quality of the coal in one of the Mabou seams. He went to the lowest part of the pit, hewed a piece of coal, broke it in three, and sent a sample of each to three chemists, one of whom was the famous Hersey firm of Montreal. Here is the average of the three analyses: volatile matter, 36; Fixed Carbon, 55; Ash, 2.55. And the writer is prepared to stand

by these figures rather than those given by the mines' staff.

The fitness of Nova Seotia eoal for steam raising purposes has been fully demonstrated during past years and partieularly during the years of the war. The Dominion Coal Co. has done a very large trade in bunkering, and no eomplaint has been made of its quality. The large quantities of coke made at the two big steel plants have amply demonstrated its suitability for coke making, and for the several bye-products so extensively used in the manufacture of munitions of war. The analyses below are given not because they are of any great praetical value, but more to show the similarity in charaeter of the eoals, and of stimulating the blood of the several General Managers who have long tenaeiously held the opinion that the very best coal in the province was in the seams which they were working:

Owners and seam	Vol. Matter	F. Car.	Ash
Dom. Coal Co., Phalen ...	31.00	62.00	5.00
" Emery ...	32.00	53.00	12.00
" Harbor ..	37.00	57.00	6.00
" Hub	36.00	58.00	6.00
" Gardner .	32.00	65.00	3.00
" Lingan ..	34.00	60.00	1.71
Seotia, Sydney Mines . ..	36.00	57.00	5.00
" Lloyds	36.00	57.00	3.00
" Collins	31.00	61.00	5.00
New Campbleton	35.50	51.55	8.95
Port Hood Co., Port Hood	35.00	56.00	9.00
Mabou 8 ft. ...	34.00	56.00	7.00
" 7 ft. ...	36.00	55.00	9.00
" 15 ft. ..	37.00	51.00	9.00
" 5 ft. ..	36.00	50.00	11.95
Inverness, Inverness	46.00	47.00	7.00
Intercolonial, Main	26.00	65.00	8.00
Acadia, Marsh	35.00	....	....
" Vale	29.00	....	....
" McBean	....	....	....
" Acadia	28.00	61.00	10.00

Acadia, McGregor	28.37	61.00	10.00
" Cage	30.00	59.00	11.00
" Foord	34.00	57.00	9.00
" Third	31.00	53.00	16.00
Mar. Coal, Joggins	41.00	49.00	11.00
Minudie, Minudie	36.00	52.00	10.00
Strathcona, R. Hebert ...	37.00	52.00	10.00
Chignecto, Chignecto	40.00	49.00	10.00
Dom. Coal, Springhill ...	34.00	59.00	7.00
" Aberdeen	32.00	60.00	7.00
" Minto	37.00	57.00	6.00

The sulphur contents of the several seams varies from .67 to 6.02; an average of sulphur of thirty-seven different mines is 2.54, which is not too bad. The coals of Nova Scotia are gassy, more especially as the coal gets to the deep, but they cannot well be called sulphurous. Indeed a study of the several analyses given in a majority of official reports, demonstrate that the mines that are classed gassy are almost free from sulphur. The several large mine explosions in the province are an irrefutable demonstration of the assertion that sulphur and mine gas are not affinities. For instance the Drummond is a gassy mine, and the sulphur in the coal placed at 1.10; the Foord is a very gassy coal with only .60 in sulphur.

MINE EXPLOSIONS AND FIRES.

It is doubtful if a correct list of lives lost in mine explosions and fires in the province has heretofore been published. To give an absolutely correct list is, perhaps, nigh impossible. The records in the Mines Office, Halifax, cannot be fully depended upon. For instance in a table taken from a paper read in 1894 by the then Inspector of Mines, the number of fatalities resulting from the explosion in the Foord pit is placed at 44, and from the Drummond Colliery explosion 55. In both instances the numbers are under stated.

Between 1832 and 1862-4, or more correctly perhaps, from the beginning of coal mining in the province up till 1864, there are no records in the Mines Office giving details as to operations at the coal mines. From say 1870, however, records have been kept, though not with perfect accuracy, in more than one instance. The fatalities from 1832 to 1862 are given at eight. The possibility is that there were eleven or twelve, though no record of these are available.

The following shows the fatalities from explosions that can be verified:—

PICTOU COUNTY.

Date	Locality	Fatalities
1836	Albion Mines	Several
1837	No. 2 Pit, Albion Mines	3
(1) 1839	Albion Mines	0
1858	Albion Mines	2
1862	Albion Mines	3
(2) May 13, 1873	Drummond Colliery	58-59
(3) Nov. 12, 1880	Foord Pit	52-53
(4) Feb. 10, 1885	Vale Mine	13-14
(5) Jan. 15, 1887	Albion 3rd Seam	..-..
(6) Aug. 8, 1893	Drummond Colliery	....
(7) Jan. 23, 1918	Allan Mine	88

CAPE BRETON COUNTY,

(8) May 21, 1878	Sydney Mines	5
(9) —— 1895	Dom. No. 1	0
(10) June 16, 1899	Caledonia	11
(11) Jan. 3, 1911	Sydney No. 3	8
(12) July 25, 1917	New Waterford	68

CUMBERLAND COUNTY.

(13) Feb. 21, 1891	Springhill	125

INVERNESS COUNTY.

(14) Feb. 7, 1908	Port Hood	10

COMMENTS ON CERTAIN OF THE EXPLOSIONS.

No. 1. Though no deaths are reported this must have been a hot if not a very heavy explosion, as so great was the heat from it that the hoisting chains were melted.

No. 2. This was the fiereest and most awesome of any of the explosions with which the mines have been visited. The noise was terrific, the bank-head and other buildings over ground were shattered, impeding attempts at rescue. A cage in a shaft with its living contents was shot up into the air. Smoke came rolling out the slope mouth in great dense volumes. Explosion sueceeded explosion. The houses in the villages were shaken at intervals well on into the night. The explosion was caused by a fire, originating from a shot, which was uncontrollable, though heroic attempts were made to extinguish it. The miner having charge of the place where the fire originated was not fatally injured, while the General Manager, who was among the volunteers, fell a vietim. In the Department of Mines report the number of vietims is plaeed at sixty. One of the names has been repeated though the spelling is altered. Mr. McDougall, the efficient and most zealous Secretary-Treasurer of the Benefit Fund has on his list 58 beneficiaries only. The writer has the

name of a volunteer carpenter as a victim. His relatives probably made no application for aid and therefore the name does not appear in the Benefit Society's books.

As indicative of the violence of the explosion an occurrence may be here related which has heretofore escaped mention. An eye witness, stationed some little distance from the slope mouth, says what brought home to him the extreme violence of the explosion was its lifting the brick cupola, 60 to 75 feet in height, completely from its foundation, before it fell in pieces to the ground.

No. 3. Probably the correct number of lives lost is 52. The Mines Report gives the number as 53, but gives the names of 52 only. The number 53 agrees with the number arrived at by one of the two enumerations on the day of the explosion, but the list of names prepared by them is missing. The explosion did no damage on the surface. One body only was brought out by the way of the shaft, after the blast. He had been asphyxiated on the level on his way to work. The 51 or 52 bodies lost in the explosion have up to this day the pit as their tomb. The explosion occurred well up to the rise in the south side. A common belief, at the time, was that a party sent to remove an old drum may have, in some way, ignited gas. It was a remote spot in the mine where the drum was located, and some one of the party may have uncovered his lamp for some purpose. This as a cause of the explosion may be correct but possibly is wholly conjectural. An attempt to reenter and open the workings, and mine the lower part of the coal, leaving an umbrella roof between the lower and upper coal in the seam, did not meet with success. Parts of the old Foord pit workings have been penetrated, but no actual attempt to recover the pit has been made since the one referred to. This is the only case in the province where the bodies of those killed in an explosion have never been recovered and thirty-eight years have elapsed since the occurrence.

4. Explosion said to have been caused by a

blown out shot and intensified and accelerated by dust.

5. Though this was a very violent explosion demolishing the bank head, reducing the mine cars to matchwood and the brattice in the mine to ribbons, no lives were lost. This latter was due largely to the fact that it occurred on a Sunday when the pit was idle. Fall of fire from the strata above was the cause. Had the slopes remained unconnected as Mr. Rutherford, a previous manager, intended they should, one side of the mine would have remained intact and not have been the source of trouble and expense it has been ever since. Previous to the explosion there were two one sided mines; that is true, but since there has been only one, at least in the upper workings.

6. This can scarcely be termed an explosion, rather a most peculiar occurrence. During an electrical storm lightning ran down the shaft, the hoisting steel rope acting as a conductor. The lightning set gas on fire but did little other damage. The fire did not continue.

7. Though this explosion is responsible for the largest loss of life next to that of Springhill, its shock was scarcely felt on the surface. No volumes of smoke issued from the shaft therefore the conclusion was come to that fire had not followed the explosion. Draeger men were soon ready but exploration was somewhat impeded by the jamming of the cage at the bottom of the shaft. A few men, subsequently to the explosion, got out by way of the Cage Pit. The shaft had connection with three separate seams. The rescuers failed in finding any living bodies. The Coroner's Jury that made investigation into the accident was composed of men of high qualification, and yet it must be stated that though they gave expression to an opinion as to the cause, the view of the jury is not accepted freely by many. From what was brought out in evidence one might conclude that the explosion occurred in the bottom seam. It may not. There are a few inclined to the

opinion that it might have had its seat in the cage seam. Some people are not assured that the cause was a defective, or any other kind of a shot, while all seem to agree that an explosive was at the bottom of it. If one is asked the question: What caused the Allan Mine explosion? the easiest and safest answer is "Cause unknown."

11. There is no doubt as to the ignition of gas set off in the course of the examination of places as required by the C.M.R.A. The examiner entering a place suddenly found himself in the dark. He retreated from the "head" or place, to the air course and sat down to relight his lamp. Unfortunately, and probably unthinkingly, he took a position, at the lower corner of the head, in the air current. The current passing took with it the escaping gas from the surcharged head. Evidently he had opened his lamp and was attempting to relight when the flame of whatever he used in so doing communicated with the gas, and a violent explosion followed, in which the examiner and seven others were killed.

12. This was like a majority of the more serious explosions, one that did so little damage on the surface and to surface plant that rescue work was possible the moment the air currents could be adjusted. Besides the Coroners inquest an official investigation was held in order, if possible to ascertain the cause. The Coroner's jury's verdict was tantamount to a censure on certain officials charging negligence. The findings of the Commission censured no one and gave what in their opinion was the cause of the explosion. In their opinion the explosion was due to an inefficient shot communicating through a lipe with gas in the back of the fall or the holeing. This finding was not unanimously accepted. Objectors to the finding claim that it may have originated at another than the point named by the Commission. No one may dispute that it was a gas or a gas and dust explosion, but they would prefer to endorse a finding such as this: "An explosion of gas and dust, place in the pit and cause of lighting

the explosive mixture unknown."

14. The cause of the explosion at Port Hood was almost identical with that of the preeeding, only naked lights were in use and the gas was set off not by an official but by a workman or workers, and in a very simple manner. A level is running, say, in a northerly direction. This level is the intake. A short distance in on the west side a balanee has been worked out. It is lying full of gass. So pure that if a man could go up ten feet and then attempt to light a torch there would be no fire. Some little distanee from the balance, and on the lower side of the level, several men, with their powder cans, which they had just brought down with them; sat or stood to have a morning chat. In some way the gas oozing from the balance was carried to where the men had congregated and the explosion was the result. It was not extensive and caused no damage of any consequence. It spent its force in a short distance. The writer, who examined the plaee soon after the explosion, sets it down as due purely to gas, as instead of gathering force as it went it expended itself in a comparitively short distanee.

Of the several big explosions in Nova Seotia, in one ease only, that of the Drummond, is the immediate cause known without dispute. It is asserted, officially, in the case of the MeBean explosion that it was traceable to a blown out shot. There were many at the time who disputed this assertion, and maintained that gas was driven down on a miner's lamp owing to a door being left open. In the ease of Springhill the weight of opinion was that a blown out shot fired the dust of the mine. Another opinion had many and strong supporters, and was to this effeet: The blown out shot is admitted. This shot was one bored down hill in what may possibly be most correctly defined as an air eourse, and not an upper level. In boring down hill, where the piteh is fairly high, the tendeney is to strike the roof. An opinion was that roof gas was liberated. Dust no doubt played the largest part. Curiously, while the

shot did not effect its purpose it brought down a huge block of coal near the face of the lower or main level, forty or more feet distant from the shot hole. A question in the mind of the writer is: "Has a fall caused by concussion in any subsequent mine explosion misled experts as to the precise locality in which an explosion originated? The explosion occurred on a Saturday and before the close of the following day all the bodies were recoverred, all except that of the Manager, Harry Swift, recovered two or three days later. The mine was undamaged.

GOVERNMENT ASISISTANCE.

Unless it can be clearly shown that the rendering of practical or, in other words, financial assistance will result in the securing of practical reciprocation from the beneficiaries in the shape of political assistance, that is, votes, governments, like heavy bodies are inclined to move slowly, very. When this can be fairly demonstrated there is astonishing exhibition of agility. The government, it is true, has rendered aid to mineral prospecting and exploitation on many occasions, but only, it may be said, after the persistent nagging by claimants, and intensive and protracted thought on the part of the benefactors. After wrestling for years with a request, by some far seeing men, it is just possible for a government to come to the conclusion that the request is reasonable, and will be of benefit to the community and make compliance with it. Take for instance the request that the government come to the assistance of mineral prospectors and exploiters, by the securing a number of diamond drills, to be loaned out to private parties, not having so ample or so elastic an exchequer as governments are commonly assumed to possess. It took several years to impress upon the government that the so doing would be a proper step, and in the interests of the province. Certain well known mining men, who had areas which they wished to test, and who were under the impression that the Department of Mines was, or ought to be, ready for new ideas, formed themselves into a delegation, and waited upon the then Commissioner of Mines—

this was in 1898. Somehow the members of the delegation had got imbued with the idea that the Honorable the Commissioner was a softish, easy going chap or in other words that he was a person they could put "one over" easily. With some confidence, therefore, if not with great boldness, they made for and entered his office. The greetings were cordial, but the cordiality ended there. The object of the delegation's visit was made known, namely that the Department purchase one or more drills to be let out on hire to responsible parties. It was pointed out to the Commissioner that the governments of Ontario and New Brunswick had each such machines, and that Nova Scotia was more of a mineral province than either. The Honorable Commissioner on hearing the request glanced at the individual members, in an effort to find if each one of them was bereft of his senses. Not one of them looked insane. Then the anger of the Commissioner broke out, down went his foot heavily, and forth came the exclamation, "The bare idea." He declared the suggestion to be Utopian, and used such other English, denoting finality, that the delegation who came thinking to shear, went forth shorn. After reaching the cool air, each admitted to the other that he had been wholly misinformed as to the Commissioner's placidity, eveness of temper, and broad mindedness. If, howevr, the first delegation was daunted, subsequent delegations were not, and stuck to their guns. The request took on, on a subsequent occasion, the nature of a demand, and of a kind to be pressed. As in the case of the unjust judge, who could not be bothered, the Commissioner of Mines finally gave way and, probably, from a similar reason and not because he thought well of the idea. Yet the drills have been of great service, and the demand for one of the several which the government purchased at odd times, has been almost continuous. Indeed the supply has not been equal to the demand. The government have at present several fine drills, diamond and calyx.

MINING SCHOOLS—TECHNICAL COLLEGE.

Whatever may be said in the way of criticism, or of the lack of sympathy of the several successive governments of the province and their seeming indifference to the physical welfare of the mineral industries; however much they may be censured for not giving material aid in mineral exploitation, nothing but praise can be expressed for the great interest taken and the aid extended to every effort whose object was the mental, social, material and physical welfare of the workers in the mines, especially that most numerous class, coal miners. Year after year in the eighties and nineties application was made to the government for this or that reform, and invariably the request met with a most sympathetic reception. The Fielding government have to their credit many reforms sought for during a period of twenty or more years, or until the colliery workers were hard put to find further requests to prefer. The several reforms it is impossible to relate at this time. Mention, however, may be made of the institution of Mining Schools, which have done more for the miners and the coal interests than most people have the slightest knowledge of. The recommendations that officials of mines should be holders of certificates of competency, did not come from the miners, but strangely from one, who on a change of positions—from the government to a corporation—renounced his first expressed views. The first requests of the workmen were for miners' certificates,

then for enginmen's certificates, and after that for certificated officials. Legislation, making the holding of certificates compulsory, led to the request for Mining Schools. Hon. Mr. Fielding made ready response, but the trouble was as to the kind of schools and the kind of teachers. Mr. Fielding wrote to the then Gen. Secretary of the Miner's Union, that he had thought of Mr. Percy, an eminent Mining Engineer in England, as a likely instructor, and Halifax as the most suitable place. The Secretary immediately on the receipt of this, went to Halifax and said that one school and that one in Halifax would be of no service, and declared that what was wanted were schools in the several mining centres, with a teacher for each school. Could mining instructors be obtained? The reply to this was "they can." From whence? From among the mine workers themselves, was the answer. "Then, said Mr. Fielding, "if it is as you say, an act for the promotion of such schools shall be passed forthwith and that was a promise that was faithfully carried out. These mining schools, simple as they were, and yet are, have been of untold advantage to the colliery workers of the province. In its legislation, relating to mining and allied subjects, the legislature of the eighties in N. S. set the pace even to Britain from whose statutes the first laws relating to mines had been obtained. In all matters relating to the safety and comfort of the miners, the governments from 1881 onward, have ever taken a sane and practical interest.

As corollary to the Mining Schools came the Night Schools, and also the Technical College. The latter statement may, by some, be hotly disputed, but reasons shall be forthcoming for its appearance. Of the Night Schools it may be said, in the one breath, that they were a failure, and an over success. The request for night schools came from the executive of the Provincial Workmen's Association and, the reasons advanced for the request may be thus summed up. Sir Charles Tupper's Education Act

did not come into effect until the middle sixties. There were neither age nor educational tests, for lads wishing to work in the mines, the consequence being that a number of workmen had got no more than a cursory elementary education, if any education at all. It was for these the schools were asked for, but on their institution a great many young lads attended, and could not well be excluded. The lads were quicker in the "up take" than their elders, who, partly through pride, became discouraged and ceased attending. The scholars should have been graded according to age, but that might mean two teachers for a small number of pupils, and the government did not feel justified in the additional expense. Of course though the schools were applied for for the colliery workers chiefly, they could not well be confined to that class. The applications for night schools from the country districts became so frequent that the Education Department was forced to discountenance applications on the ground that the schools were intended only for those who had not opportunities to attend the regular day schools in their younger days.

Harking back to the Mining Schools. At a meeting in Halifax called nigh twenty years ago, by the Governors of Dalhousie College in furtherance of a prospect for the institution of a "School of Mines" the late H. S. Poole, the then Gen. Manager of the Acadia Coal Co., made among others, the following remarks:—

"In our own province instruction has for years been given to candidates seeking certificates as overmen, and managers. The classes at the mining towns have been well attended and the results for good have been most marked. Men of character and determination have come to the front and mine owners have been helped to select from among the workmen those better fitted to fill positions of authority. For many years I was chairman of the Board of Examiners for granting these certificates, and consequently in a position to judge of the strong and weak

points of the system. It was very apparent that the efficiency of the teachers had much to do with the number of candidates who came before the Board, and the per centage of failures.'' ''Efficiency'' does not necessarily stand for most learned. Some of the teachers who were not highly educated were the most successful in imparting the knowledge that was essential to a successful examination. When by statute, it was ordained that ''Managers''—not U. G. Managers—must be holders of certificates of service or competency, a somewhat anomalous position was created. How could those notholding higher than underground managers certificates be expected to impart the necessary instruction to candidates desirous of qualifying for the higher grade, This for a time was a poser. The difficulty was tided over by having a college bred young man tour the several mining districts and supplement the work of the district instructors. It was not long before there was an ample supply of instructors holding the higher certificates. These schools are still in existence and doing excellent work, work which no college, nor school of mines could do so conveniently, economically and thoroughly.

Mr. Poole's endorsement of the Mining Schools stands for much when it is remembered that on the request for the schools being first preferred, he objected on the ground that it would take away an honored prerogative of the General Managers, the sole privilege of the selection of officials, and that the choice would be prescribed. Instead of that a very much larger field was provided to select from. Nor was Mr. Poole at first enamoured of the act prohibiting the employment of miners not holding certificates. His comment before the committee of the Legislature half jocularly made was:—''I suppose they''—the ''they'' referred to the two representatives of the Provincial Workmen's Association—''will soon demand that a laborer shall not be permitted to wheel ashes from the fire doors unless he is holder of a barrow man's certificate.''

The writer, having played a part in the establishment of the Mining Schools, may have, naturally, a strong bias in their favor. The following paragraph from an independent source is therefore in order:

The technical education of mine officials is a matter in which Nova Scotia has been a pioneer on the American continent. The provincial mining schools are designed to enable aspirants for official positions to qualify for the certificates of competency of various grades required by the provincial laws. These scools—really evening classes—are held in the various mining centres; and a small equipment is provided to enable elementary instruction to be given in physics, machine-drawing, surveying, electricity, and other mining subjects.

The province is the possessor of a handsome Technical College under a highly qualified staff from Professor Sexton down. So far the attendance of pupils has not overtaxed the building or the staff, but no doubt pupils will increase, when the cost of their maintenance in the city decreases after the war. Two difficulties stand in the way of pronounced success, the one financial and the other that the college is not near enough to permit of the use of its equipment by students who are days' wage men. In an effort to overcome this difficulty in a measure, the College has instituted correspondence courses These courses will be made to harmonize with the work of the technical evening classes in the several parts of the province. Referring to the Technical College the following is reproduced, from a bulletin issued by the Ottawa Department of Mines, being in harmony with the frequently expressed views of the writer:—

"The Technical College at Halifax has been the subject of criticism because of its distance from the chief industrial centres, but it is difficult to see how the Provincial authorities could better reconcile

the conflicting claims of the scattered coal districts than by building the first technical college at Halifax, as a centre from which the activities of the Technical Education Department can work.

It should be found possible, by a system of scholarships awarded on the excellence of work done in the evening mining schools, to select promising students for short mining courses in Halifax, and thereby remove the financial limitation that prevents many young miners from taking advantage of the Halifax Technical College."

To whom belongs the credit of originating, or who first fathered the idea of a Technical College for Nova Scotia. There are many aspirants, and many somewhat amusing claims. The Nova Scotia Mining Society claims to first have had its finger in the pie. Individual members of the society say, "that may be, but I brought it first to the Society's notice." The fact is the idea was promulgated long before any society took it up—in a mining paper of the province. As already stated the College was a corollary of the Mining Schools; it had to come sooner or later. But who is to get the credit of its actual accomplishment? The government? Yes, of course—in a sense, if individuals or a government can honestly be given credit for doing that which circumstances compelled to the doing. Who is responsible for the compulsion? Curiously, the colleges in the provinces. Three or more of the colleges, all of a sudden, took it into their heads that they must divert more attention to mining subjects. More than one of these colleges were called denominational. Dalhousie was not, and for a time, and for that reason, it was thought that governmental assistance might go to Dalhousie. At least one other college "sat up" on getting this hint, and sent a strong delegation to Halifax, urging that the government give a grant,—the request was a most formidable one--in order that this college might be equipped thoroughly for a specific purpose—the turning out of highly trained M. E.'s. C. E.'s. and the like. Dalhousie and Kings could

have put in a similar plea, namely, that they had already much equipment, and have preferred a similar claim for heavy financial assistance. The government knew well that it could not give big grants to three or more colleges, and, further, that the sparse population could not supply pupils for three or more colleges. For the government there was only one safe way out, and that a Provincial Technical College. The great success of the Mining Schools emboldened the government in taking this important forward step. The college had to come; having come it is the duty of all interested in the progress of the province to give it every encouragement.

THE COAL COMPANIES OF NOVA SCOTIA.

DOMINION COAL COMPANY. Head Office, Montreal: Mark Workman, President; Alex. Dick, Sales Agent; A. J. Tonge, General Superintendent; R. Gordon, Comptroller; V. McFadden, Chief Electrician; James D. Maxwell, Assistant to Superintendent; J. W. Revere, Purchasing Agent.

District Superintendents: A. McEachren, Alex. McDonald, and A. S. McNeil.

S. B. McNeil, T. Chew and Fergus Bryne, Safety Inspectors, C B. Wm. D. Matthews, Springhill.

The collieries operated by this Company are as follows:

DOMINION No. 1 COLLIERY, Dominion. Equipped for output of 700,000 tons annually. Highest output, 1902, 697,000 tons,—1917, 378,000 tons. John Munroe, Manager.

DOMINION No 2. New Aberdeen. This is the largest and most elaborately equipped colliery of the company. The output has gone as high as 817,000 tons. P. T. Pendergast, Manager.

DOMINION No. 4. Caledonia This is the oldest working colliery of the Company, getting on the last lap of the half century mark, and yet full of vitality. It is still good for half a million tons yearly output, given a fair chance. John Casey is Manager.

DOMINION No. 5. Reserve Mines. W. G. Ross is Manager. Twenty-five odd years ago this was the best producer on the Southern side of the Island. Before the Dominion Coal Company took it over, its coal

went over the S. and L. Railway and vessels loaded at its pier in Sydney Harbor. The colliery served its owners well. It may, like Bridgeport, last more years than was allotted, but of a truth, in the words of that most touching old Scots song, five years ago, Reserve might have thus saluted Bridgeport :

We're wearing awa' Jean,
Like snaw drifts in tha' Jean

DOMINION No. 6, Donkin. Between Dominion No. 4 and 21. Made famous by the big law suit between Dominion Steel and Dominion Coal—before they were joined in brotherly bonds. The colliery is on the Phelan seam, but the Steel company sought to prove that it was not as free from sulphur as at the collieries on the same seam to the North. With willing workers the colliery should show heels to 300,000 tons yearly. W. R. McDonald is Manager.

DOMINION No. 7. Hub Seam, Glace Bay. Daniel J. McCuish is Manager. This colliery is good for at least 225,000 tons yearly.

DOMINION No. 9. Harbor Seam, Glace Bay. D. H. McLean, Manager. This colliery, under favorable conditions, should be good for 450,000 tons or over.

DOMINION No. 10. Emery Seam, Reserve Mines. This colliery is on one of the smaller seams and yet is good for 216,000 tons a year. J. A. McDonald is Manager.

DOMINION No. 11. This is another colliery on the Emery Seam. It has yet to make a record. The output in 1917 was 121,000 tons. James R. McNeil is Manager This may be called a re-opened mine.

DOMNON No. 12. Victoria Seam, New Waterford. Output 1916 297,632 ; the year previously, 1915, it was 369,451. Angus R. McDonald is Manager. The scene of a great explosion, July, 1917.

DOMINION No. 14. Victoria Seam, New Waterford. The output for fiscal year, 1916 was 349,268 tons, This colliery under favorable conditions should be a producer to the extent of 400,000 tons yearly, Bart Connors is Manager.

Dominion No. 15. Lingan Seam, New Water-

ford. Output for 1916 278,676 tons. John P. McIntyre is Manager.

Dominion No. 16. Lingan Seam. This colliery is good for 275,000 tons or over. James Connors is Manager.

Dominion No. 17. Victoria Seam, near New Waterford. This colliery is being kept pumped out, awaiting an influx of labor.

Dominion No. 18, 19, 20 are numbers held in reserve for collieries to be opened in the New Waterford district when the opportune time has arrived.

Dominion No's. 21 and 22 are two trim collieries of moderate size which have been a pleasing surprise to the Company. It was thought at first that the distance between the outcrops would restrict operations. The seam however,—the McAulay—widens as it runs southerly. The output of 21 in 1917 was 165,000 tons and of 22—171,000, both showing a decided increase over 1915. Dominion No. 21 has for Manager, Neil A. McDonald and Dom. 22 Robert Simpson.

Nova Scotia Steel and Coal Co. Head Office, New Glasgow. Colliery Offices, Sydney Mines. The following mines were in operation:

Princess Colliery. Main seam, Sydney Mines. The coal from this mine is chiefly submarine. From the bottom of the shaft a haulage road extends three miles to the boundary line between the Dominion Coal Company's property and the Company's which lies further seaward. The Manager is Robert Robertson. In normal times this colliery is a large producer, considering that it is a hand pick mine.

Florence Colliery. Main Seam, Sydney Mines. The output in 1916 was 173,732. This is a machine mine. Mr. Angus Ferguson is Manager.

Scotia Colliery. Main Seam. The output, 1916, was 131,120. The Manager is Archibald Ferguson.

Queen Colliery. Main Seam. This colliery was abandoned when 'Scotia' acquired the property from the G. M. A. Nigh a score of years ago it was reopened and has been a good producer since, though its days are numbered.

Jubilee. A and B Collieries. No's, 3 and 4 Seams. The No. 3 Shaft is 560 feet from surface; an extension further down of 180 feet taps No. 4 Seam. From both seams good outputs could be obtained. The Manager of Jubllee A is Peter Christianson.

BRAS D'OR COAL COMPANY. Bras D'Or. Colonial Colliery, No. 1 Collins Seam and Colonial Colliery, No, 2, 4th, Seam, Colonial Colliery, No. 3, 3rd, Seam, was not working in 1917. The water is, however, kept pumped out. George B. Burchell is General Manager.

INDIAN COVE COAL COMPANY. Indian Cove, C. B. This company has absorbed the Sydney Coal Company, and purpose sinking new slopes and extending the business. Connection will be made with the C. G. Railway. The office of the company is in North Sydney

INVERNESS COUNTY.

INVERNESS RAILWAY AND COAL COMPANY. Inverness. Seven foot seam. Capable of an output of 300,000 tons, which may be increased if plans for working the other seam turn out successful. The colliery and railway are now in hands of a Receiver, J. McGillivray, who is keeping the plant in excellent condition until the physcological moment arrives for a sale or transfer of the property.

PORT HOOD COLLIERIES, LTD. New mine being opened 1918. The mine, after a time, will be wholly submarine. It is now believed that the area extends submarine for a considerable distance. There are those who think that the seam now being worked is an extension of the Mabou seven foot seam. D. A. McCuish is Manager.

EASTERN TRUST COMPANY are presently holders of the Mabou areas on which there are several fine seams of coal ranging from five to seventeen feet. Tunnelling and proving of the seams have been carried on

lately and may be continued till a fuller knowledge of the field is acquired.

Areas held by E. L. Thomas. Chimney Corner Mine, 16 miles North of Inverness town ; and St. Rose mine, 12 miles North of Inverness. At both mines sinking of slopes and shafts have been prosecuted for some time. The areas lack, as yet, transportation facilities.

Mine at Kelly's Cove, New Campbleton, being opened out. Norman McKenzie, Glace Bay, Consulting Engineer.

Pictou County.

Acadia Coal Company. Head and General Offices, Stellarton, N. S. Hector Prudhomme, Vice-President and General Manager ; George Gray, Assistant Manager and General Sales Agent ; Felix Notebaert, Chief Engineer and Assistant Manager ; Pierre Lechien, Chief Accountant, and E. Martheleur, Electrical Engineer.

The Company operates mines in the Stellarton and Thorburn districts.

The Albion Mine, formerly called the 'Back Mines,' is the outlet for coal from three different seams, namely, the Foord, Cage, and Third seams. The coal also, for years, from the Four Foot Seam, came by way of this slope, but meantime none is being extracted from that seam. Outputs have been retarded by intermittent fires. The Albion is, as yet, the largest producer. Sutherland McDougall is Manager.

McGregor Mine. McGregor Seam. Connection by tunnell has been made with three underlying seams, and by bore-hole with several at a greater depth. Slopes to connect with the underlying seams are being driven, and will soon be in operation. A seam below the McGregor is being developed. Samuel Moss is Manager.

Allan Mine. The hoisting shaft is over 1200 feet deep and connects with the Foord, Cage and Third seams. The coal in the Foord Seam is of great thick-

ness and in places in the mine runs as high as forty-seven feet. The ground in the vicinity being disturbed accounts for this variation. Edward O'Riley is Manager.

McBean Seam, Thorburn. A new slope is being driven into this seam. The old slope was flooded many years ago when the mine exploded and took fire. The new slope may not be a producer till 1919, as it may be driven 1200 feet or more, before places are broken off.

Six Foot Seam, Thorburn. Closed for a few years. Again opened up—1918—to help meet the abnormal demand likely to continue for years. The daily output is 250 tons, which may be increased. Wm. Arthrell is Manager.

The several collieries of the Company are expected, by the beginning of 1919, to be good for a production of two thousand tons daily or over.

INTERCOLONIAL COAL COMPANY. Head Office Montreal. General Offices, Westville, Nova Scotia. Charles Fergie, President; W. Maxwell, Gen'l. Manager; R. McDougald, Cashier; Percy Gordon, Comptroller.

Drummond Colliery. Main and Second Seams. A fifty year old colliery which has had vicissitudes of fortune. The most violent explosion—if not attended with the greatest loss of life—befell this colliery in 1872, and a fire and slight explosion in 1915 led to the abandonment of the lower part of the mine. The main slope at this time was over 9000 feet in length and had far passed the point where it was predicted the coal would be cut off by a fault. The colliery maintains a fair ourput and is good for many years.

GREENWOOD COAL COMPANY. Mine at Thorburn. The Officers of the Company are James R. Porter, President; Malcolm Beaton, Vice-President and General Manager; J. W. McLeod, Sec'y.-Treasurer. This it one of the mines that have made good. The seam is of a convenient size. The first workings had natural drainage. The output the year after opera-

tions began was 53,000 tons, a remarkable showing. The local government rendered material assistance, possibly for the first time in the history of coal mining in the province ; this assistance was by guarantee of a loan which was easy of liquidation.

Milford Mining Co. Seam, Coalburn. Alex Sutherland, Manager and one of the two known proprietors. The mine has not, as yet, a large output, and is not intended to be a large producer.

Cumberland County.

There are more thin seams in Cumberland than in any other county in which coal is being worked. There are, of course, several seams of moderate thickness from which good outputs are obtained.

Dominion Coal Company, Springhill. No. 2 colliery, No's. 1 and 2 seams. No. 3 colliery on No. 3 seam. The two collieries in 1916 produced 370,766 tons. In December, 1916, No. 3 colliery was lost for a time, by a fire originating in the pipe bord. Pipe bords are held to be responsible for more than one fire in Springhill. Efforts are being made to restore the former prestige of these collieries. Malcolm Blue is Manager ; D. Stewart, Assistant Manager, etc.; John J. Nicholson, Mine Manager and Alexander McLeod, Cashier. The Dominion Coal Company acquired the mines from the Cumberland Railway & Coal Company eight years ago. A new slope is being sunk east of the old East slope.

Maritime Coal, Railway & Power Co., Ltd. Joggin Mine. Joggins Seam. This mine is worked long wall advancing, makes very little gas. The main slope is down 4200 feet. R. J. Bell is General Manager. Of late years the company has done well and made reasonable profits. Charles J. Kent, Manager.

Kimberley Mine. Minudie Seam. The Minudie Coal Company ceased operating this mine in December, 1916. The Maritime Coal, Railway & Power Company now operating began in April, 1917. The work is being extended.

St. George Mine. Chignecto Seam. The work-

ings consist of bords driven off an old slope. This slope is about three-fourths of a mile to the east of the old Chignecto Colliery.

FUNDY MINE. Hardscrabble Seam at Joggins. The slope is down 275 feet, natural ventilation adequate for all purposes, Sydney Greer is Manager.

STERLING COAL CO. Sterling Mine, Kimberley seam. This slope is half a mile west of the Kimberley slope and is on the Kimberley seam. Office, River Hebert. Harry McCarther, Manager.

PROVINCIAL MINING CO. Operated by McKinnon and Jones. Scotia Mine, Maccan seam. Slope is down 310 feet , worked bord and pillar uphill. Office, Chignecto.

EASTERN COAL CO. Operated by W. L. Barnes. Lawson Mine. Lawson seam. Slope is down 350 ft., worked longwall, natural ventilation, adequate for all purposes. Office Maccan.

FENWICK COAL CO. Fenwick Mine. Chignecto seam. Situate about one and a half miles east of St. George mine at Chignecto. Slope down 340 feet. This slope was first sunk about thirty years ago and abandoned, the present company began operations in March, 1917. D. A. Ferguson, Secretary, Amherst.

MINUDIE COAL CO. Victoria Mine. Victoria seam. There are two seams of 2½ feet being worked, method of working longwall uphill.

BANK OF NOVA SCOTIA. Operated by Alder Pugsley. Strathcona Mine, Strathcona and overlying seam. Two slopes are worked at this mine. The one on the Strathcona seam is down 250 feet, the other on a seam 1600 feet south of the slope on the Strathcona seam, worked longwall uphill.

ATLANTIC COAL CO. Maccan. Newly opened mine. Isaiah McCarthy, Maccan, Manager.

EASTERN COAL CO. Maccan. Another of the newly opened small mines. W. L. Barnes, Maccan, is Manager.

THE NEW SEAMS, STELLARTON.

Results of borings referred to on pages 334-335 :

No. 1	Main Seam or Foord Seam	38 ft.
	Measures	148 "
No. 2	Cage Pit Seam	22 "
	Measures	106 "
No. 3	Third Seam	11.9 "
	Measures	113 to 127 "
No. 4	Purvis Seam	3.0 "
	Measures	109 to 130 "
No. 5	Fleming Seam	5 6 "
	Measures	5.6 "
No. 6	McGregor	14.10 "
	Measures	211.0 "
No. 7	Stellar Oil Coal	5.0 "

BORE HOLE FINDINGS.

By Bore hole on No. 5 Level West, McGregor Seam.

McGregor Seam.		
	Measures	34 ft.
	Coal and Shale	7.5 "
	Measures	1 "
No. 8	Coal	21.9 "
	Measures	14.4 "
No. 9	Coal	3.6 "
	Measures	128 "
No. 10	Coal	5.0 "
	Measures	32 "
No. 11	Coal	1.0 "
	Measures	0.4 "
No. 12	Coal	5.2 "
	Mea ures	62 "
	Coarse Coal	1.5 "
	Measures	83 "
	Coarse Coal	0.4 "
	Measures	25 "
No. 13	Coal	2 5 "
	Measures	1.3 "
No. 14	Coal	26 "
	Measures	48 "
No. 15	Coal	2.5 "
	Coal and Shale mixed	2.6 "

	Measures	74 ft.
No. 16	Coal	20.4 "
	Measures	36 "
No. 17	Coal	1.6 "
	Measures	31 "
No. 18	Coal	23.0 "
	Measures	39 "
No. 19	Coal	24 0 "

(For thickness of other seams see page 44.)

NOVA SCOTIA COAL SALES BY DECADES.—1811-1910.

Year	Sales	Total	Year	Sales	Total
1811	8,516		1864	576,935	
1812	9,570		1865	635,586	
1813	9,744		1866	558,520	
1814	9,866		1867	471,185	
1815	9,336		1868	453,624	
1816	8,619		1869	511,795	
1817	9,284		1870	568,277	
1818	7,920			———	4,927,339
1819	8,692		1871	596,418	
1820	9,980		1872	785,914	
	———	91,527	1873	881,106	
1821	11,388		1874	749,127	
1822	7,512		1875	706,795	
1823			1876	634,207	
1824	27,000		1877	687,065	
1825			1878	693,511	
1826	12,600		1879	688,624	
1827	12,149		1880	954,659	
1828	20,967			———	7,377,426
1829	21,935		1881	1,035,014	
1830	27,269		1882	1,250,179	
	———	140,820	1883	1,297,523	
1831	37,170		1884	1,261,650	
1832	50,396		1885	1,254,510	
1833	64,743		1886	1,373,666	
1834	50,813		1887	1,519,684	
1835	56,434		1888	1,576,692	
1836	107,593		1889	1,555,107	
1837	118,942		1890	1,786,111	
1838	106,730			———	13,910,136

1839	145,962		1891	1,849,945	
1840	101,198		1892	1,752,934	
	———	839,981	1893	1,485,924	
1841	148,298		1894	2,019,742	
1842	129,708		1895	1,831,357	
1843	105,161		1896	2,047,133	
1844	108,482		1897	2,013,421	
1845	150,674		1898	2,135,397	
1846	147,506		1899	2,419,137	
1847	201,605		1900	2,997,546	
1848	187,643			———	20,552,536
1849	174,592		1901	3,119,335	
1850	180,084		1902	3,898,626	
	———	1,533,718	1903	4,621,074	
1851	153,499		1904	4,544,609	
1852	189,076		1905	4,475,284	
1853	217,426		1906	5,194,590	
1854	234,312		1907	5,046,690	
1855	238,215		1908	5,485,583	
1856	253,492		1909	4,615,713	
1857	294,198		1910	4,896,896	
1858	226,725			———	45,898,410
1859	270,293		1911	5,556,464	
1860	322,593		1912	6,177,615	
	———	2,399,829	1913	6,478,709	
1861	326,429		1914	6,164,600	
1862	359,637		1915	5,757,907	
1863	429,351		1916	5,933,710	
			1917	5,143,074	
				———	41,212,079

STAFF OF DEPARTMENT OF MINES.

Hon. E. H. Armstrong, Commissioner of Public Works and Mines; Hiram Donkin, C. E., Inspector of Mines; Inspector of Quarries, etc., R. D. Anderson, Halifax.

Deputy Mine Inspectors: South Cape Breton District, J. J. McNeil, Glace Bay, and Michael McIntosh, New Waterford; North Cape Breton District, Neil A. Nicholson; Inverness District, W. F. Davies, Port Hawkesbury; Cumberland District, E. B. Paul, Springhill, and Pictou District, R. H. Gray, Stellarton.

SOME PRODUCTION COMPARISONS.

The following memo of the largest outputs of the several larger coal companies since 1902 may be interesting, as showing the possibilities of production in normal times. The figures deal only with sales and not production. Why give sales instead of production? For the reason that sales give a fairer view of progress. The tables in the annual Mines Reports show striking difference in the consumption of coal at the collieries, a difference in some cases of ten per cent. Assume that two companies have an output of 250,000 tons each a year. The colliery consumption of one equals thirteen per cent. of the output, and of the other five per cent. This shows that the latter company made larger sales by twenty thousand tons than the first, thereby making an additional saving or profit of at least $100,000. The smaller consumption at the collieries the larger quantity to send to market :

Name of Company.	Largest sales.	Year obtained	Sales 1917
Dominion Coal Co.	4,273,000	1913	3,210,000
N. S. S. & Coal Co	817,000	1910	555,000
Acadia Coal Co.	465,000	1913	350,000
Cumb. Ry. & Coal Co	435,000	1992	———
Dominion Coal Co.	362,000	1908	297,000
Mar. C. Ry. & Power Co.	197,000	1917	197,000
Intercolonial Coal Co.	280,000	1906	147,000
Inverness Ry. & Coal Co	273,000	1913	app. 200,000
Bras D'Or Coal Co.	52,680	1913	38,000
Greenwood Coal Co.	39,000	1917	39,000
Milford Coal Co.	14,000	1917	14,000
Minudie Coal Co.	49,250	1916	27,934

The sales of the four companies last named are for the fiscal year ending September.

Other companies doing business in 1917 which made no report for 1916 were Strathcona Coal Co. (re-

opened); Provincial Mining Co.; Atlantic Coal Co.; Eastern Coal Co.; Stirling Coal Co.; Fundy Mine, and Fenwick Coal Co,, all in Cumberland Co. The combined sales of these were small, being less than 40,000 tons.

The shortage of labor, due to the war, is not wholly responsible for the large decline in 1917. For instance the Dominion Coal Co. lost tonnage by the explosion at Dominion No. 12, and the Acadia Coal Company suffered loss by outbreaks of fire at one of their best producing collieries. The output from the Springhill mines was likewise curtailed by the closing of a colliery, due to fire, while the large discrepancy in the case of the Intercolonial Coal Co. is mainly due to the abandonment of the lower lifts, which had to be flooded owing to a sudden minor explosion of gas followed by the firing of the coal.

The table following shows the greatest outputs obtained from each individual colliery of the Dominion Coal Company, and, for comparison, the outputs for year 1917:

Colliery	Greatest Output	When Obtained	Output. 1917
No. 1 Dominion	697,000	1902	378,000
" 2 New Aberdeen	817,000	1912	719,000
" 4 Caledonia	689,000	1902	377,000
" 5 Reserve	803,000	1903	105,000
" 6 Big Glace Bay	273,000	1915	249,000
" 7 Hub	222,000	1913	102,000
" 9 New Aberdeen	430,000	1912	273,000
" 10 Reserve	216,000	1912	96,000
" 11 No. 4	121,000	1917	121,000
" 12 New Waterford	383,000	1914	184,000
" 14 " "	416,000	1913	243,000
" 15 " "	289,000	1915	168,000
" 16 " "	260,000	1914	194,000
" 21 Birch Grove	165,000	1917	165,000
" 22 " "	191,000	1915	171,000

* * * *

P. S.—D. H. McDougall is now President of the Nova Scotia Steel & Coal Company.

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